THE IRON AGE

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JUNE 27, 1935

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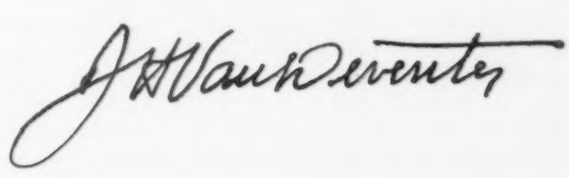
Skating on Thin Ice

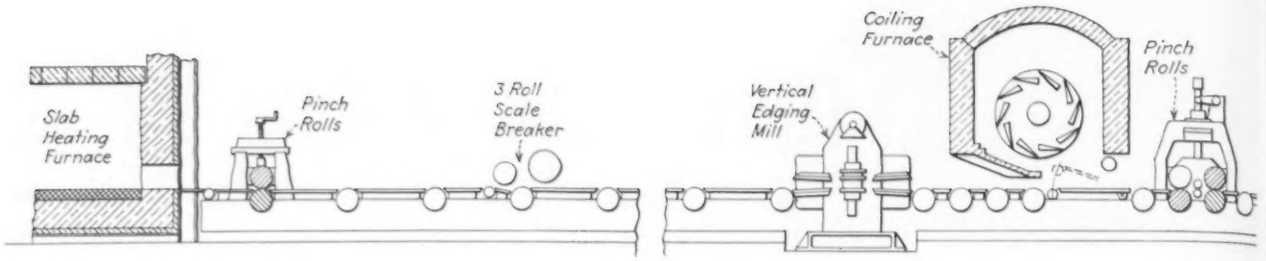
Do you remember the real old-fashioned winters that we had when you were a boy? And how the fellows looked forward to the first freeze so that they could get out their skates and indulge in the risky pastime of skimming over the "rubber" ice? If you kept going fast enough, you might get by without a ducking; although the thin ice would bend and form a wave in front of your feet.

Few of us would care to repeat this experience today, for we are older and know something about the risk involved and then too, we have recollections, perhaps, of playmates who broke through the fragile surface and were drowned in the dark, chilly waters.

Congress seems to be skating upon thin ice today, judging by its actions. Apparently many of its members are endeavoring to glide over an area where the constitutional footing is so attenuated that speed of action is all that keeps them from breaking through. Being young, careless and full of the joy of a better life, they play follow the leader, forgetting altogether the sad demise of their little playmate, NIRA, who broke through the ice just recently and whom diligent application of Administrative pulmotors failed to revive.

If the risk of wandering from the firm grounds of constitutionality were confined to the venturesome souls in Congress and in the Administration who care for this pastime, none of us could complain and many would rejoice. Unfortunately, however, they insist on making the entire population follow suit, so that we all stand to get a ducking, or worse. Senator Wagner seems to be particularly without fear of consequences to the public, who are asked to play snap-the-whip under the leadership of his Social Security Act and his Labor Bill. Undoubtedly this rash pair will sooner or later crash through the thin ice on which they are skating and join NIRA in the cold waters of oblivion, but until they do they promise to give both capital and labor many a chill and many a spill.





Hot Strip Steel Rolled

HOT strip steel is now being rolled on a commercial basis on a single-stand reversing mill of the Steckel type. Small steel companies for the first time thus are enabled to produce their own hot strip steel economically, using this type of mill, which has an output of from 25 to 35 per cent of that of a continuous strip mill and an initial cost approximately one-sixth that of a continuous mill. The mill is expected to be widely used in foreign countries where tonnage requirements are limited and hence huge initial investments are not justified.

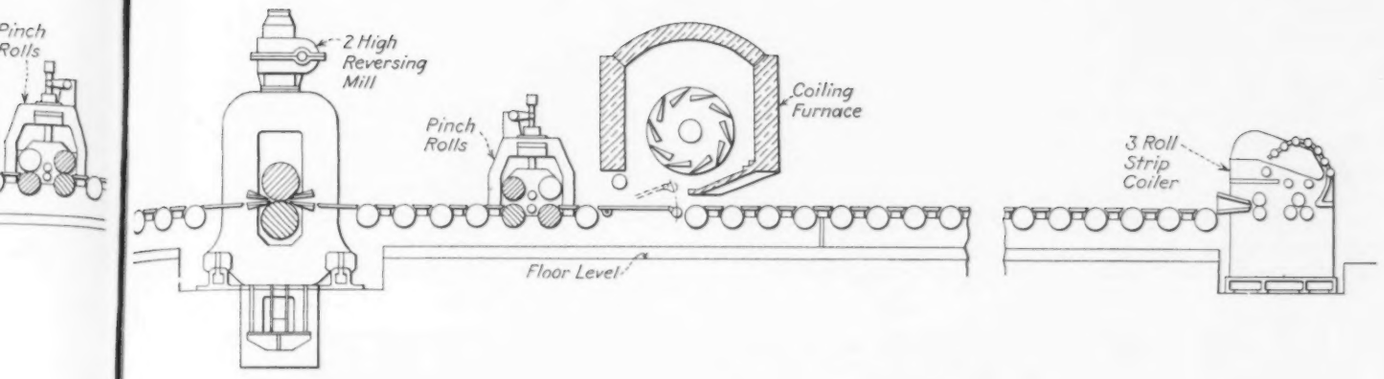
One of the new mills capable of rolling strip 16 in. wide has been put into operation by the McLouth Steel Corpn., Detroit, and another is in production at the Indiana Harbor, Ind., works of the Youngstown Sheet & Tube Co. A third mill, for rolling material 36 in. wide, has recently been completed at the plant of Dominion Foundries & Steel, Ltd., Hamilton, Ont. This mill rolls directly from a slab ingot into strip without reheating. Other companies which desire to be in a position to install this type of mill in the future have made licensing agreements with the Cold Metal Process Co., Youngstown, Ohio, which possesses exclusive patents covering mills of Steckel design. Licensees include the Weirton Steel Co., Great Lakes Steel Corpn., Follansbee Brothers Co., Continental Can Co., Allegheny Steel Co. and Inland Steel Co., in addition to the steel companies already mentioned.

The raw steel to be rolled into strip on this single-stand reversing hot mill may be a slab ingot or a slab or a fairly heavy plate, depending on the plant facilities available. In some instances, especially where high production is sought, a universal plate mill is placed ahead of the hot strip mill. The slab is first rolled on the universal mill to a thickness of about 1 to 2 in. and then, without being reheated, is passed on to the strip mill, which rolls it to the desired gage. It is claimed that the combination of the universal mill and the strip mill results in production of approximately one-half the tonnage secured on a modern continuous hot strip mill.

Rolling procedure on the single-stand hot strip mill is of special interest. The slab is heated in a slab-heating furnace in the usual manner, being ejected from the furnace on to the approach table in front of the mill. It passes through an edging stand to control the width of the finished material. At this point scale is removed from the slab by means of high-pressure water sprays. The slab then moves on to the mill, which, for the first few passes, is operated in the same fashion as a reversing plate mill. The edging rolls, too, are employed for several passes.

HOT strip steel is now being rolled commercially on a single-stand reversing mill of the Steckel type. Economy in initial investment and in operating costs is claimed for the new mill, which enables small steel companies to produce their

At either side of the mill, placed sufficiently above the center line of the table that the slab may move freely underneath, is a coiling furnace in which coiling reels are located. After the strip has been reduced to a thickness of about ½



On Steckel-Type Mill

in. it is passed into one of the furnaces, the end of the strip being diverted into it by a deflecting apron. During the flat passes, the apron is lowered so that the steel passes over it, but without making contact. Aprons are located on either side of the mill below the coiling furnaces.

own hot strip steel. This article describes the manufacture of strip by this process and enumerates the advantages claimed for it. A detailed account of the installation at the McLouth Steel Corpn. plant, Detroit, is given.

At the entrance to each furnace is a roller around which the strip passes as it coils on the coiling reel. Because the strip is bent to an angle greater than a right angle, the secondary scale is removed by the bending operation. After most of the strip has been wound on the coiling reel, the end passes entirely through the mill, stopping under the pinch rolls nearest to the furnace in which the steel has been coiled. The mill then is reversed, with the pinch roll serving as the necessary power to introduce the strip into the mill stand. The deflecting apron on the opposite side of the mill is raised to divert the end of the strip into the other coiling chamber. This back-and-forth operation is repeated until the strip has been reduced to the desired gage. After the final gage has been reached the strip moves on to the runout table and is either cut to length or coiled on the unloading coiler.

The coiling furnaces in which the reels rotate are maintained at a temperature of 1400 to 1700 deg. F. during the rolling passes in order to maintain the strip at the proper heat. The heating medium may be gas or oil. The mill is driven by a d.c. variable-speed motor. A separate drive is provided for the pinch rolls and reels. Control is maintained by means of the Ward-Leonard system.

Hot strip steel rolled on the single-stand reversing mill is claimed to have a smooth edge free from checks or cracks because the edges of the strip are the hottest portion of the rolled material. This freedom from defects is particularly desirable when the strip is to be cold rolled into sheets or tin plate, or is to be used for welding, or if automobile wheels or other parts are to be spun or formed from it.

It is said to be possible to keep the strip during the rolling process at the temperature most desirable considering the quality of the material being rolled and the metallurgical results required. Considerable leeway is possible with respect to maximum and minimum temperatures. It likewise is possible to vary the number of drafts.

Since a uniform temperature can be maintained, strip is rolled accurately to gage and with a minimum of center crown (difference in thickness between the center of the strip and the edges). Considerable quantities of hot strip are reported to have been rolled on this type of mill in which there was a center crown of about 0.001 in. in material 30 in. wide with a finished thickness of 0.109 in.

In the rolling of low-carbon steel it is desirable to produce large coils. The new mill is capable of rolling coils weighing 300 lb. per in. of width. For example, a steel company now contemplating instal-

lation of one of the new mills is figuring on rolling 54-in. strip in coils weighing 16,000 lb. In this particular case the limiting factor is the size of the ingot produced.

The operating cost of a single-stand reversing hot strip mill is claimed to be exceptionally low because of the long life of the rolls and consequently the small roll cost. Power cost also is economical because "stand-by losses" are reduced to a minimum on a single-stand mill having only one motor.

A mill capable of rolling strip up to 36 in. wide can be housed in a building 80 x 300 ft. The small space required cuts down the investment in land and in buildings. Fixed charges are kept relatively low, too, by the fact that production of a single-stand mill is in line with consuming requirements and can be operated at a relatively higher average rate than larger mills. Roll changes can be made in less than one hour, since only one pair of rolls is used.

In addition to rolling strip, this mill is suitable for rolling universal plate and skelp. Either slabs or slab ingots may be employed as the raw material. Up to the pres-

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AN oil-fired continuous slab heating furnace heats for hot rolling 15 tons of slabs per hr. Furnace is 56 ft. long and 34 ft. wide. Slabs are placed on rails in front of pusher head by magnet crane and are pushed through furnace by oil hydraulic pusher having stroke of 4½ ft. The pusher has slow forward stroke with much faster return stroke to facilitate placing slabs on charging hearth.

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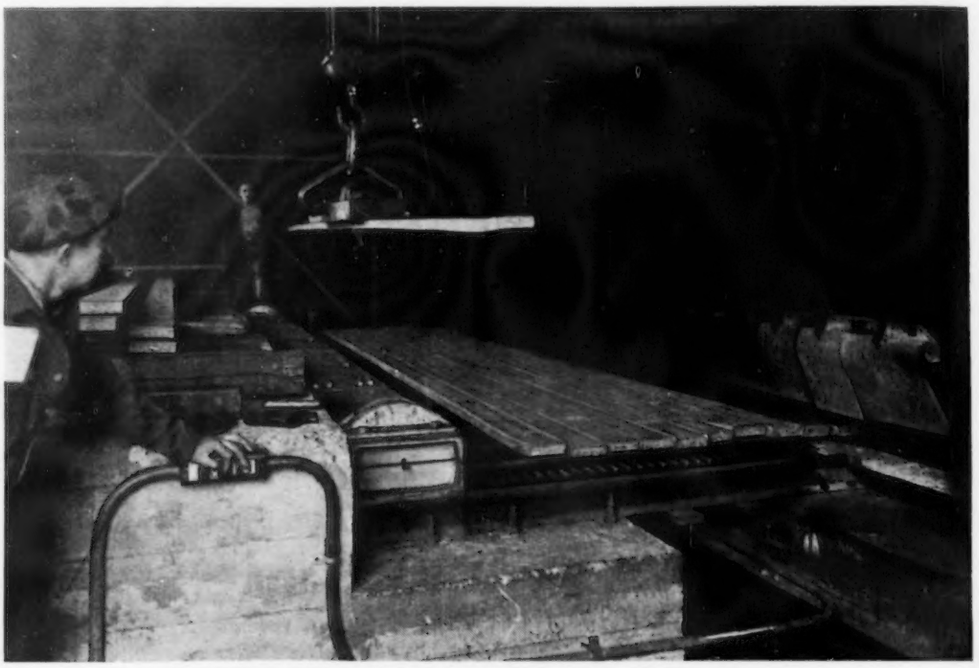

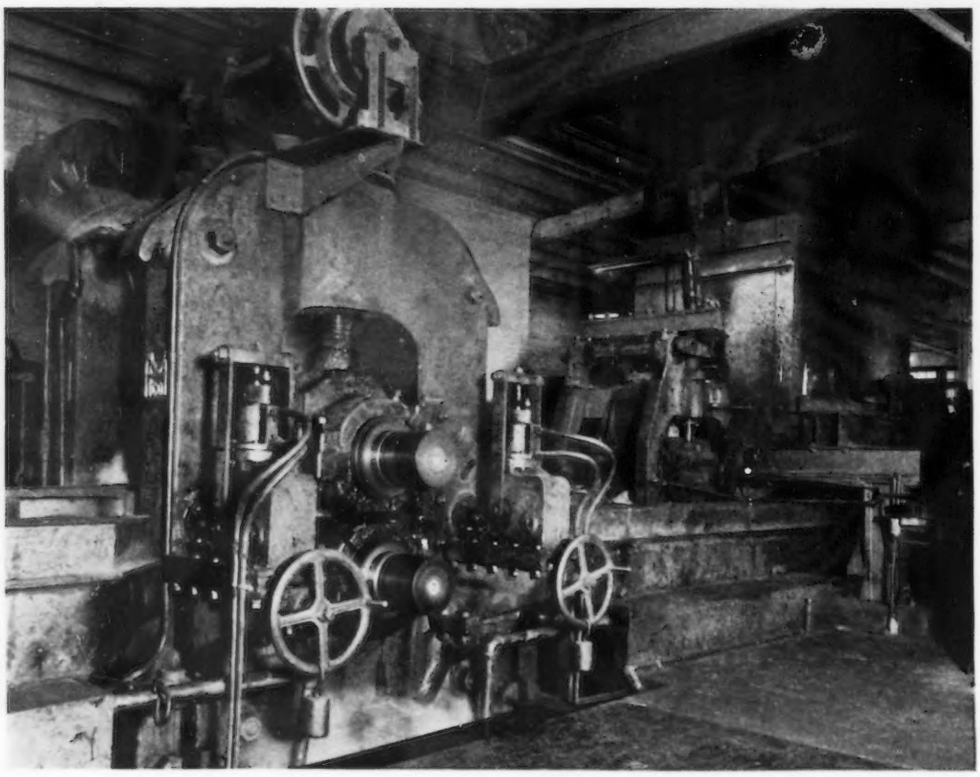

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THE two-high reversing mill has a periphery speed of 430 to 935 ft. per min. Rolls are 21½ in. in maximum diameter on body and 20 in. on face. Roll necks, 16 in. in diameter, operate in anti-friction bearings. The mill is driven by a 2100 hp. variable-speed motor running at 230 to 500 r.p.m.

o o o

AT RIGHT

HOT strip entering vertical edging mill, with one of the coiling furnaces in background. Mill is actuated by 100-hp., 475-r.p.m. motor through an independent, inclosed reducing drive. Rolls are power-adjusted by twin screws, the pass opening being shown on a large dial at the top of the mill.

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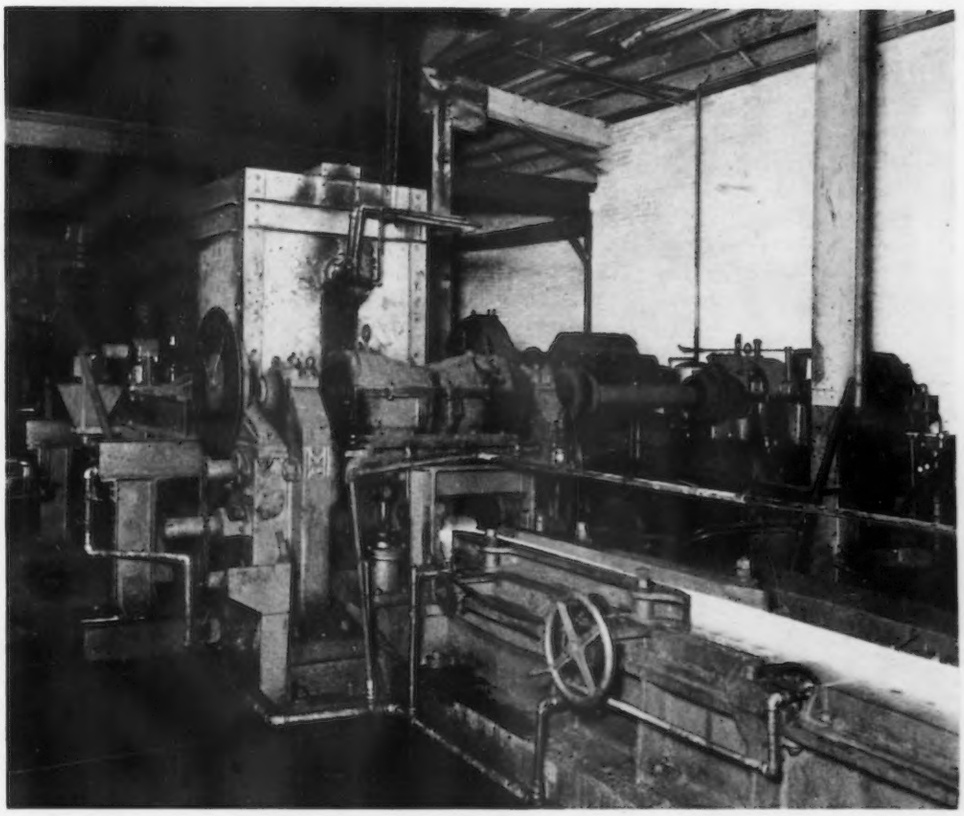
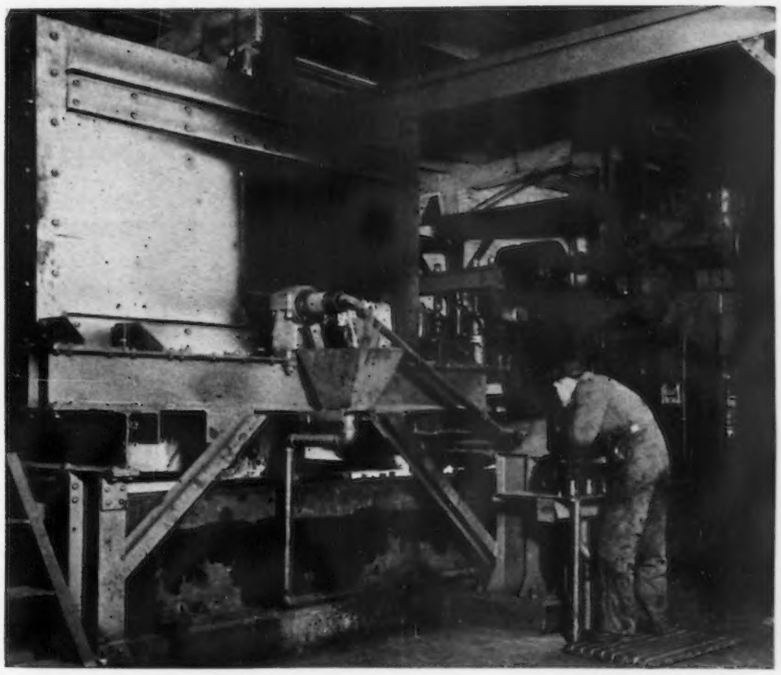
BELOW

AFTER the strip has been reduced to a thickness of about ½ in., it is passed into a coiling furnace containing coiling reels. Because the strip is bent to an angle greater than a right angle, secondary scale is removed by the bending operation.



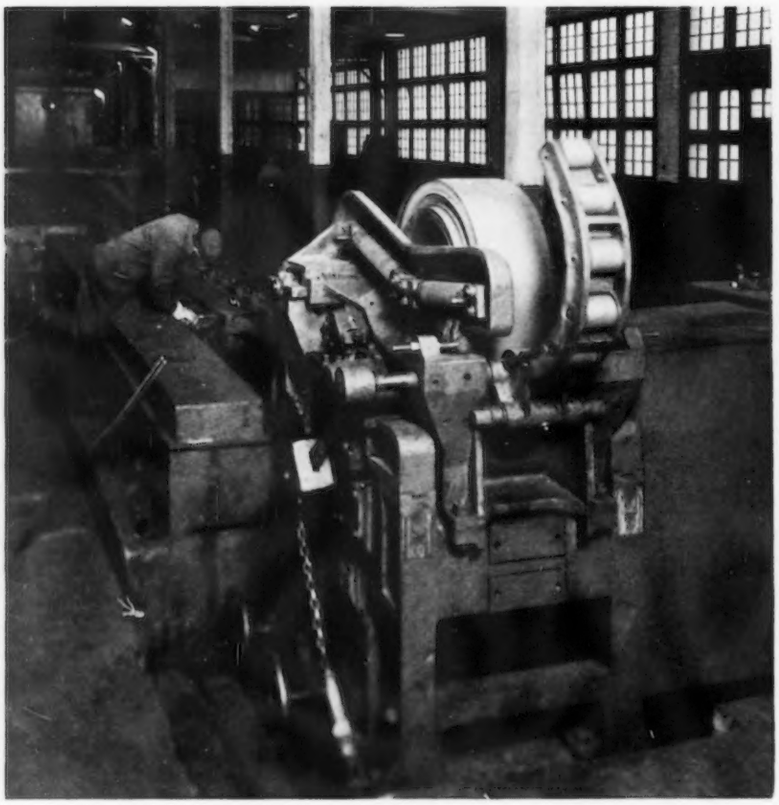


ent time low-carbon and high-carbon steel, stainless steel, high-silicon steel, Monel metal, nickel, copper and brass have been rolled, either commercially or experimentally, on this type of mill.

It is estimated that the single-stand mill will roll 10 tons per ft. of width per hr. of No. 14 gage material. This would be equivalent to 30 tons per hr. when rolling 36-in. strip. When the mill is used in conjunction with a universal mill, similar to the installation at the Indiana Harbor plant of the Youngstown Sheet & Tube Co., the capacity is raised to 12½ to 15 tons per ft. of width per hr., or 25,000 to 30,000 tons per month of 36-in. strip.

Equipment at the McLouth Steel Corpn. is comprised of two stands of edging rolls and a two-high, 20-in. reversing mill. The pinch rolls, in fact, are an integral part of the roller table in that the first roll at the heating furnace end forms the lower roll of the pinch rolls. They are carried in housings attached to the table beams. The table rollers are 12 in. in diameter, 20 in. long and spaced on 4-ft. centers. They are driven through bevel gearing by a 35-hp., 600-r.p.m. motor, operating at a speed of 875 ft. per min.

The vertical edging mill is actuated by a 100-hp., 475-r.p.m. motor through an independent, completely inclosed reducing drive. The rolls have a pass diameter of 12½ in. and are turned with necks 7 in. in diameter and 9 in. long for mounting in bronze bushings. They are power-adjusted by twin screws, the pass opening being shown on a large dial at the top of the mill. The maximum of the pass opening is 16½ in., the minimum 4¾ in. A pinch roll attachment is incorporated in the table to control the vertical alinement of the strip in the edging pass.



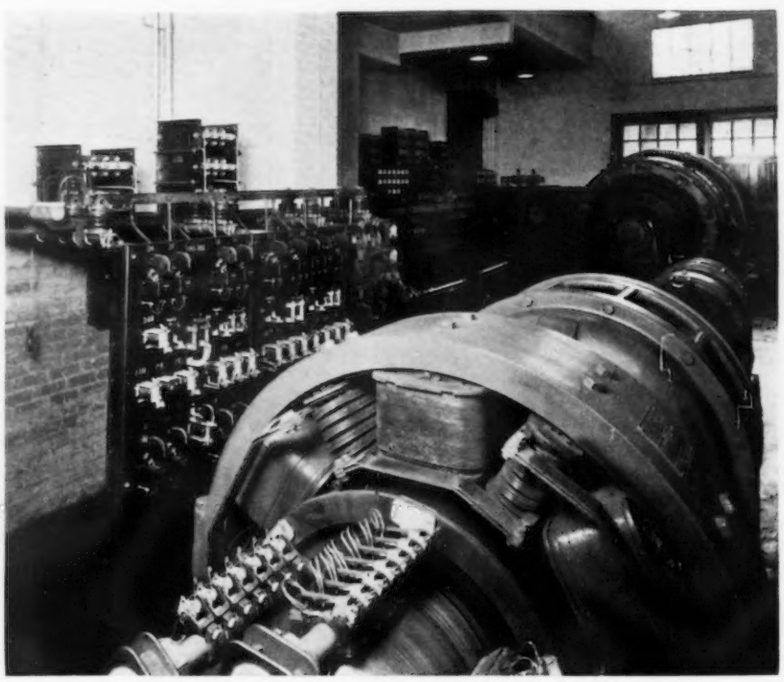
THE coiling machine has a pair of pinch rolls and three bending rolls, each 7¼ in. in diameter, and two coiling rolls 5½ in. in diameter. In connection with the machine is a framework with seven guide rollers which swings out from the coil by means of an air cylinder to allow coiled strip up to 40 in. in diameter and 16 in. wide to be removed. The runout table is 86 ft. long.

The slab moves from the edging mill to a stand of pinch rolls of the duplex type equipped with two pairs of 12-in. diameter rolls 20 in. long. The upper rolls are raised and lowered and the driving pressure between each of the rolls maintained by a system of air cylinders. A set of trip rollers, which is part of the mechanism, automatically reverses the direction of rotation of the pinch rolls and the mill table. Pinch rolls are driven through a combination reduction gear set and pinion stand by a 35-hp. motor. The lower pinch rolls and table rollers are driven through a flexible coupling of the floating shaft type. One upper roll is actuated by means of a universal coupling spindle, the second upper roll through a sprocket and chain from the first upper roll. On the opposite side of the mill is a second stand of pinch rolls similar to the one described.

Equipped with rolls 21½ in. in maximum diameter on the body and 20 in. on the face, the two-high reversing mill has a periphery speed of 430 to 935 ft. per min. Roll necks, which are 16 in. in diameter, operate in anti-friction bearings. The bottom roll is driven through a machined splined spindle and coupling boxes. The upper roll, balanced by counterweights located beneath the housings, is actuated through a universal coupling spindle. The spindles are connected through a stand of mill pinions and gear reduction to a 2100-hp. variable-speed motor running at 230 to 500 r.p.m.

Speeds of the motors operating the reels in the coiling furnace are synchronized with those of the 2100-hp. motor driving the two-high reversing mill. They are automatically adjusted to compensate for the increasing diameter of the coil on the winding reel and for the decreasing diameter of the coil on the unwinding reel. Operation is so smooth that there is no tendency for the strip to buckle or be under unusual tension during the rolling process. Reels, pinch rolls, and front and back mill tables reverse with the mill motor. Speeds of pinch rolls and of front and back tables correspond to that of the mill motor.

The runout table from the mill to the coiling machine is about 86 ft. long. It, and also the mill approach table, has rollers 12 in. in diameter and 20 in. long, actuated by a 35-hp. motor at a speed of 875 ft. per min. Side guides are adjustable by hand by means of screws and chain, the maximum



ELECTRICAL equipment for the mill is housed in a small separate room.

width being 16 in. and the minimum 6 in. The coiling machine has a pair of pinch rolls and three bending rolls, each 7¼ in. in diameter, and two coiling rolls 5½ in. in diameter. All the rolls are 20 in. long. The lower pinch roll and the two lower bending rolls are adjustable by hand-operated worm, worm wheel and screw.

In connection with the coiling machine is a framework with seven guide rollers which swings out from the coil by means of an air cylinder to allow coiled strip up to 40 in. in diameter and 16 in. wide to be removed. Side guides with long rollers are mounted on a heavy base which spans the two roll housings. The pinch, bending and coiling reels are driven by a 15-hp., 850-1700-r.p.m. variable-speed motor. The driving gear shafts, driven rolls and all guide rolls are equipped with roller bearings. The coiling machine is designed and powered to handle wider strip in case any changes might be desired in the future.

An oil-fired continuous slab heating furnace heats for hot rolling 15 tons of slabs per hour from a cold state to 2200 deg. F. Slabs range in size from 6 to 16 in. in width and from 12 to 25 ft. in length. The furnace is 56 ft. long and 34 ft. wide. Slabs to be heated are placed on rails in front of the pusher head by a magnet crane and are pushed through the furnace by means of an oil hydraulic pusher having a stroke of 4½ ft. This provides space for loading four or more slabs in front of the pusher.

The pusher is propelled forward by two cylinders tied together to insure uniform movement by means of pinions mounted on a common shaft on the pusher carriage and engaging stationary racks located on the charging platform. This arrangement insures uniform movement of the two ends of the pusher head. The pusher has a rather slow forward stroke with a much faster return stroke to facilitate placing slabs on the charging hearth.

The control valve is located at the discharge end to enable the operator of the discharging mechanism to advance slabs through the furnace. Slabs are pushed out through a side discharge door by a manually controlled pusher bar actuated by a hydraulic double pinch roller located at the door. The rollers of this device are electrically operated and controlled by means of a controller within convenient reach of the operator of the pusher bar.

The furnace is arranged for firing with oil by means of low-pressure oil burners, all of which are placed across the front of the furnace. The burners are divided into two separately and automatically controlled zones. The air for combustion purposes is supplied by a motor-driven blower which takes the supply of air from over the roof of the furnace and under an insulated cover to be preheated. This firing arrangement provides a desirable flame condition and tends to yield a uniform heating condition throughout the furnace.

In the design of this furnace every effort was made to insure a soft, uniform heat throughout the slab, in contrast with the usual method of a sharp heating process with a relatively high temperature gradient. The furnace temperature is automatically controlled by means of control instruments operating in conjunction with automatic valves on fuel supply lines. With this arrangement the fuel supply is changed, in small increments and by automatic means, so as to fol-

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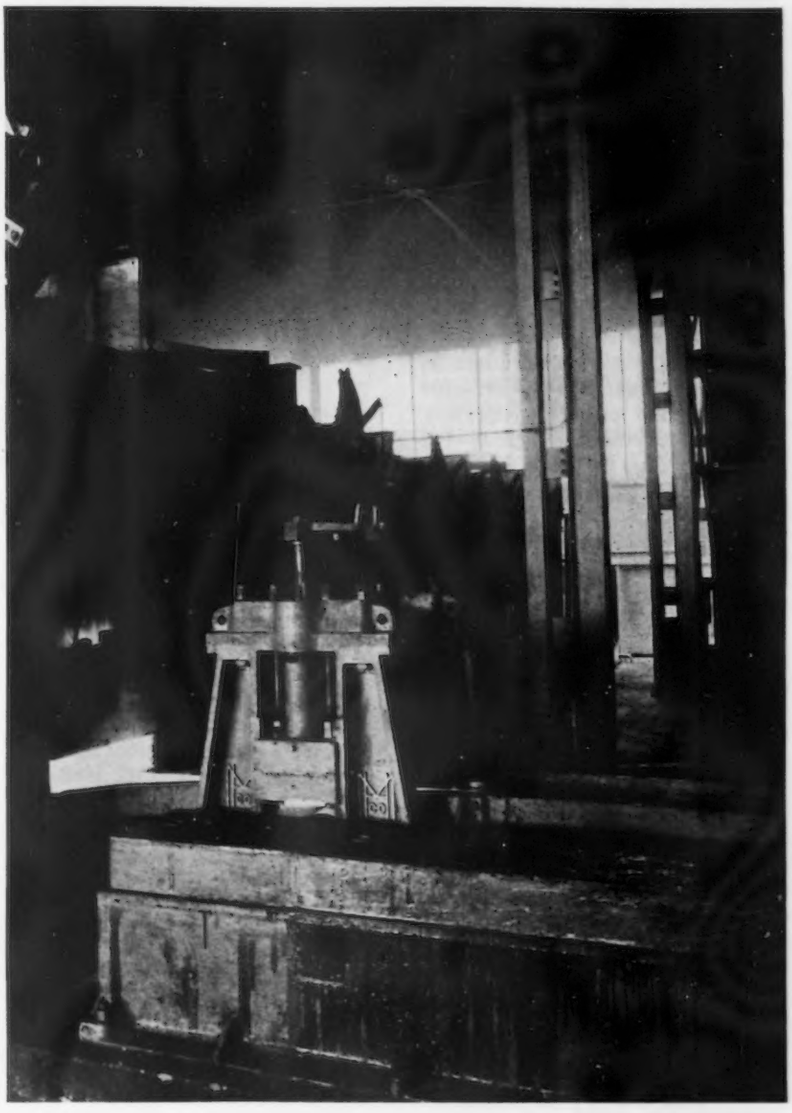

SLABS are pushed out of the slab heating furnace through a side discharge door by a manually controlled pusher bar actuated by a hydraulic double pinch roller located at the door. Rollers of this device are electrically operated and controlled by means of a controller within convenient reach of the operator of the pusher bar.

The Role of Metals

THE railroad is America's oldest large industry. By way of contrast, the automobile industry is still largely dominated by the same man who helped to create it. When that man started there was already a well-established science of materials. When the railroads started there were neither suitable materials nor a definite knowledge of such as did exist. The railroads created both. Perhaps a few highlights of the history of railway development will best illustrate its technical heritage.

The first rails consisted of iron bands, spiked to timbers which were laid partly in the ground. Next came cast iron flats about 4 in. wide and 3 ft. long. These weighed some 40 lb., and herein may lie the origin of the custom of gaging rails by so many pounds per yard. These flats were laid on stones in the earth. The cross-tie was not used owing to the very practical consideration of towing the train home by horse.

The first profiled rail to be rolled in America came out in 1844. It was an inverted U. In 1846 the T-rail followed, and this is the progenitor of our rail section of today. These rails weighed some 52 lb. per yard and were about 18 ft. long. Steel rails did not appear until 1865.

The 4-ft. 8½-in. track gage did not become standardized in the United States until 1886. Up to that time it varied from 2 ft. on some Southern roads to 6 ft. on the Erie.

However, not all difficulties were confined to the rails. The first mooted question about locomotives concerned traction. Early scientists insisted that rail friction was not enough; the engine ought to be geared to the track.

While the earlier development in steam engines stood the railroads in good stead, there was still a lack of suitable material as well as a technique for handling that which was available. One early boiler had fire flues made of old gun barrels.

The safety valve often consisted of a mere wooden plug driven home with a bung-starter. When it blew out, as it often did on grades, passengers joined the train crew in "hunting the plug." The idea of a spare plug never seemed to have found favor.

Metal — and metal meant wrought iron—was as sparingly used as possible. All structures, be they cars or bridges, were made of wood. The first iron bridges were built in the late '60's, while all-metal coaches were not introduced until 1907—some 40 years after.

Long before the railroads became concerned with the proper use of proper materials, they were confronted with a shop problem. Standardization of track gage in '86 meant interchange of rolling equipment. It also meant that cars must be made serviceable in shops, not necessarily on the home line. This one factor has had much to do with the shaping of railway equipment standards. It still has, and rightfully so.

Railway engineers are not unsympathetic to progress; they simply dare not defy the many inhibiting factors peculiar to railroad operation. It is all well and good to upset convention, but when by so doing the result leads to nation-wide confusion the accomplishment is of doubtful worth.

With this in mind, it becomes understandable how such simple materials as malleable, cast steel and structural shapes can persist in the face of more valuable metals. They are universally available and they require no such special technique of application as would the heat-treatable alloys.

We must further understand that until very recently the railroad management has been absolutely indifferent to weight excesses, so long as equipment has complied with its ideas as to maintenance, safety and serviceable life. In this respect, railroad engineers have built even better than they knew. Over 60 per cent of available locomotives today are over 20 years old. Coaches built for a useful life of 20 years are still running after 25. The supposedly obsolete wooden passenger cars have not yet been fully retired, and were it not for wrecks freight equipment would seemingly last forever.

Just what price has been chargeable to continued operation of the obsolete and the excessively heavy will never be known. We only know that conditions have changed. The business offered is no longer so good as to be profitable, regardless of the plant engaged in it. Unfortunately, while business quickly adapts itself to changed conditions, the railroads have created for themselves, or had imposed upon them, a large and unwieldy structure of finance, organization and equipment. A change here will be slow and deliberate, but it will come, for the railroad is fundamentally still the ideal carrier of goods and people.

Ever since transportation became a commercial venture, the basis of revenue as well as cost of operation has always been figured on weight. The carrier naturally only gets paid for the weight of the cargo offered for shipment. He pays, however, for the movement of both cargo and vehicle. It is to his interest then to maintain a reasonable relation between the weights of each.

Just how far our railroads have departed from this sound premise has been the subject matter of many surveys and reports—most of them dated since 1929. It is true, however, that freight revenue is still calculated on the basis of weight, but how? There are over 5000 different freight classifications and few of the distinctions bear any relation to cost of service. But, even under the most ideal conditions we find, for instance, that one ton mile of train movement is required for every one ton mile of coal hauled. The proportion for other classifications is even less favorable. In pas-

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in the Railway Industry

By E. J. W. RAGSDALE
Chief Engineer, Railway Division, E. G. Budd Mfg. Co., Philadelphia

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senger service, the preponderance of equipment weight is tremendous. However, passengers pay by the head and not the pound, so it is, perhaps, only fair to figure train weight per person. This varies from two to ten ton miles for every passenger mile. The passenger pays here in the East 3.6c., or in the South, 1½c. for that service. If the same tonnage used to accommodate him were offered as freight, the tariff would be many times greater.

Obviously something has got to be done to rehabilitate the railroads. They have got to be reorganized on the basis of carrying goods rather than encumbered by the methods of doing business. The traffic must be analyzed for simplification of movement and for the type of equipment best suited to make that movement. Much old rolling stock is still economically usable. New equipment should be considered, first, for those services where the old is obviously unsuited, and second, where new business may be attracted. Only a very few railroads in America make money on passenger business, and it is here that a beginning has been made. Light-weight trains make for reduced operating cost, on the one hand, while speed with its concomitant streamlining are calculated to attract new business.

But, above all, weight reduction is the order of the day. Weight reduction, however, does not fit into the railroad man's picture of safety and endurance. The feeling that "weight is strength" is of too long standing to be readily argued away. Past failures have been too often corrected by use of more metal to inspire confidence in any reduction. These seemingly irreconcilable desires of a reduced weight and an even better endurance, have been finally adjusted through introduction of what we may call "light-weight construction."

Light-weight construction may be defined as a more efficient use of a more efficient material.

An I-beam, for instance, may represent a fairly poor use of mild steel, especially when compared to a highly efficient bridge girder where this same material is uniformly stressed to its working limit. Substituting a high-tensile steel having three times the strength into the I-beam may increase the strength of that beam by 3, but if built instead into the girder, this may then be conceivably six times as strong as the original I-section. Such is the spirit of light-weight construction. One well built girder uses the same weight of material as does the conventional section, but replaces six of them. Aviation knows this relation as the "strength-weight ratio."

NEW materials in combination with new designs are bringing about profound changes in railroad equipment. An appraisal of the problems involved in the use of new materials and of the possibilities such applications offer for the future was made by the author in an address, reproduced here substantially in full, before the American Society for Metals at New York, May 24. Colonel Ragsdale's views are of particular interest because he speaks with the authority of one who has played a leading part in developing the streamlined stainless steel passenger train.

Interpreted into car building, this works out about as follows. The roof and floor are indispensable members, anyhow, why not use them as top and bottom chords of a beam? All that is required is to organize the equally necessary side walls into shear members.

Contrasting to this is the conventional railway coach which is built up on heavy center and side sills with the walls below the windows acting in support. The roof being insufficiently attached against horizontal shear, merely acts as a separate stiffening member, but does not become an integral part of the structure as a whole. In other words, the mild steel constituting the car structure has not been used to best advantage.

Having decided upon a better utilization of material, the next step involves selection of that material. This is more difficult. Two metals automatically suggest themselves; the aluminum alloys and high-tensile stainless steel. Both balance out in any strength-weight comparison. With a weight ratio of approximately three to one, ultimate strength, yield point and modulus of elasticity show a ratio of one to three. Furthermore the cost per pound is also about the same, namely about 35c. Decision between these two dissimilar types of metals will rest upon conditions other than those of structural equivalents. Methods of design, endurance, shop practice and even prejudice will be determining.

More aggravating is the question as to whether or not either of these materials can be economically justified. There are cases where no other material serves the purpose, and then again, there are cases where use of these alloys is simply a wasteful procedure. In

between lies a border zone of highly debatable application. This zone is being narrowed from the bottom by a new series of low alloy steels and from the top by cheaper applications of aluminum and stainless. The price differential between 5c. for the former and 35c. for the latter would seem to make decision obvious, but such are the newly recognized economics of weight that base prices may become a very fallacious indicator.

Just here, it might be well to state that this paper, which is entitled the "Role of Metals," appears to deal more with economic considerations than with the characteristics of metals. But, after all the true role of materials of any sort is the serving of an economic purpose. Such purpose brought metals into prominence in the first place, and now a revision of our economic viewpoint results in the introduction of newer materials.

With the premise granted that rolling equipment must be lighter and yet unreduced in either endurance or factor of safety, both a new design and superior materials are automatically indicated. The cost and extent of the lightening will be balanced against expected savings in operation. The arithmetic of it is really quite simple, which accounts, perhaps for the numerous and, often, discordant answers obtained.

Less simple but far more definite is the structural analysis. It proceeds on the basis that a passenger coach, for instance, is made up of one-third by weight of car body; one-third by appointments, and one-third by trucks. Reduction of appointment weight permits a reduction of body structure, and this, in turn, permits a still further structural reduction. The eventual weights of body and appointments determine the truck loading and hence also its weight.

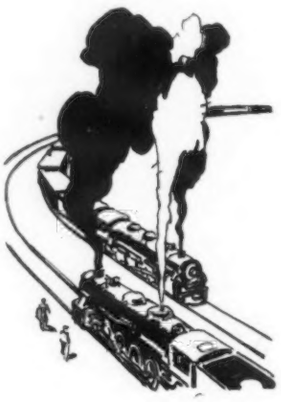
As beneficial as is this cycle of weight reduction, it is well, however, to bear in mind that it can be just as vicious if taken in reverse. Every pound added to a structure adds just so much to structural requirement.

How Passenger Train Weights Can Be Pyramided

An interesting example of how weights can be pyramided is offered by a study of the Burlington Zephyr. This three-car Diesel-electric train as built of stainless steel, originally weighed 208,000 lb. Actually the amount of stainless involved was only 46,000 lb., or 22 per cent of the total. It would scarcely seem that substitution of so little stainless by a less valuable metal could be significant and, yet, had this train been built of a low alloy steel, its final weight would have been 320,000 lb.—an increase of over 50 per cent.

Considering that the low alloyed steels have about half the strength properties of cold-rolled stainless and none of its corrosion resistance, about two pounds of one would be required to replace one pound of the other. The first increment is then 46,000 lb. This increases the load and accordingly involves some 24,000 lb. more metal for structural reinforcement. Both items reflect themselves in an increased truck weight of 15,000 lb. and by now the relation between train weight and available power has become so disturbed that the original 600-hp. engine no longer suffices. It requires instead a 900-hp. engine which brings the total train weight from an original 208,000 lb. to 320,000 lb. In other words, for each pound added to the load, there has been another pound and a half picked up by the car structure, the trucks and the power plant.

The worst of it all is, however, not that the train weighs more. but that an economy attempted through use of a cheaper material has resulted in an actual extravagance. The cost of the stainless steel built into the Zephyr was $20,000. (It would be less today.) That of the low alloy steel offered in its place would have been $5,800. This apparent saving of $14,200 is immediately offset by a $31,000 increase in the cost of the power plant. So, use of a cheaper metal shows already a net loss of $15,800. Add to this $4,000 a year increased operating expense and it will be found that the experiment in substituting a low-priced steel for the much more expensive stainless has tied up a capital investment of nearly $100,000.



But, so strong is the impression created by a high metal cost, and so little appreciated are the economics of rolling weight, that one readily balks at the first and swallows the second. Actually the whole cost of the stainless steel in the Zephyr amounted to only 8 per cent of the total train cost. Far more significant would seem to be the fact that the three Zephyr-type trains now in service on the Burlington road are showing an earning capacity equal to about 50 per cent return on the original investment. These trains will pay for themselves in two years. Why worry then about the relatively small item for the metal which has contributed so largely to the successful operation and to the attractiveness of the train?

In the above analysis, the determining factors have been: a fairly high power cost, a high performance, a factor of safety in keeping with greater speeds, a very low cost of operation and, above all a capacity to attract public favor.

The cumulative effect of these not only justifies use of the best available materials, almost regardless of cost, but makes such seemingly inevitable. Less favorable, for instance, is the situation with reference to freight cars. While these contribute a very much larger proportion of railway movement than do passenger cars, and while they particularly invite reduction of weight, there are other considerations which decidedly limit the cost at which this can be accomplished.

In the first place, a freight car rarely remains on the home line. When off it, the home line receives a flat rental of one dollar a day. When requiring repair, the home line is billed for such. There is, in consequence, little incentive to reduce cost of haulage at the expense of a higher first cost, but there is a great incentive toward a lowered liability to damage. Freight cars are, after all, chiefly

(CONTINUED ON PAGE 80)

A.S.T.M. Investigates Hardness Testing and Creep of Aluminum Alloys

MEETING this week in Detroit, members of the American Society for Testing Materials are deliberating some 48 technical papers and over 45 reports from various committees. Not only are many of the tentative standards being broadened, but a number of the technical reports cover original investigations of particular interest to the ferrous and non-ferrous industries. Two papers are devoted to aluminum alloys, namely, the correct method of determining hardness values and the creep characteristics at various temperatures.

There is no test used more frequently in laboratories than the hardness test, of one type or another. The hardness tests most widely used in this country are the Rockwell, scleroscope and Brinell, and the success attained in applying these hardness tests to ferrous metal products has quite naturally suggested similar uses in the non-ferrous fields.

However, in the non-ferrous fields the metals are generally softer, with the result that certain modifications in the test conditions must be made if satisfactory results are to be expected. These changes in test procedure usually involve lower loads on the penetrators, or larger penetrators, or both, in the case of the Rockwell and Brinell tests; and larger striking face radius of the hammer (lower contact pressure) in the case of the scleroscope. These more obvious differences in conditions make it quite difficult to compare values of ferrous and non-ferrous metals when using the prevailing standard methods.

In the application of these hardness tests to the light alloys of the non-ferrous metals, still other difficulties have been encountered that make comparisons of hardness values for different light-metal products quite unsatisfactory. In some specific instances, however, the hardness tests can be and are very useful in controlling the uniformity of certain operations applied to some of the light-metal products. These specific instances were reviewed in considerable length on Tuesday by R. L. Templin of the Aluminum Co. of America, in a paper entitled The Hardness Testing of Light Metals and Alloys.

The first phase of hardness testing of light alloys discussed by Mr. Templin was the application of the Brinell test. He stated that the Brinell hardness of light non-ferrous metals is defined as the ratio of a given load (in kilograms), applied to a hard metal ball of given size for a given time, to the spherical area (in square millimeters) of the recovered impression made in the test specimen. The basic conditions generally recognized for the test require the use of a 500-kg. load on a 10-mm. diameter steel ball for 30 sec. Both analysis and experiment have demonstrated that departures from this load and ball size can be made with quite satisfactory results if the load used is maintained equal to five times the square of the diameter of the ball used. In commer-

Table I—Hardness Values Obtained on Wrought Aluminum Alloys With and Without Oxide Coatings

All Specimens ¼-in. Thick

Material	Surface Condition	Brinell Hardness: 12.61-Kg. Load, 1/16-in. Ball	Brinell Hardness: 500-Kg. Load, 10-mm. Ball	Vickers Hardness: 5-Kg. Load	Vickers Hardness: 15-Kg. Load	Rockwell Hardness [a]: "E" Scale	Rockwell Hardness [a]: "S" Scale	Scleroscope Hardness, Magnifier Hammer
2S, as rolled	freshly machined	33.0	35.4	37.1	38.3	35	79	14
	original oxide coating	34.5	35.1	38.6	38.7	35	79	14
	0.0002-in. oxide coating	38.8	36.4	40.2	39.7	36	80	14
	0.0008-in. oxide coating	39.8	36.8	44.3	40.9	36	80	15
53S-T	freshly machined	87.3	92.0	89.2	92.8	93	109	32
	original oxide coating	86.0	89.0	91.1	90.3	93	109	31
	0.0002-in. oxide coating	87.3	91.2	94.6	92.0	93	109	32
	0.0008-in. oxide coating	97.2	91.0	104.8	98.1	94	109	32

[a] "E" scale—100-kg. major load, ⅛-in. ball (red or "B" scale).
"S" scale— 60-kg. major load, ⅛-in. ball (red or "B" scale).

cial testing balls from 1/16 to 9/16 in. in diameter are used.

Etched Hultgren balls are sometimes used on brightly finished products to assist in reading impression diameters. Little if any attention is given to the question of ball lubrication in testing light metals. No differences that can be ascribed to lubrication are indicated between results obtained with etched Hultgren balls (dry) and polished steel balls lubricated with heavy colloidal graphite grease.

For Brinell hardness tests made using the 500-kg. load, 10-mm. ball combination, the depths of impressions will vary from 0.0313 in. for a Brinell value of 20, to 0.0063 in. for a value of 100. The depths of the impressions made by other sizes of balls under the proper loads will be directly proportional to the diameters of the balls.

The Society's standard methods of Brinell hardness testing of metallic materials (E 10 — 27) state that the thickness of the specimen should be not less than ten times the depth of the Brinell impression, and according to Moore the depth of impression should not exceed one-seventh the thickness of the specimen if comparable values are expected. The less conservative of these limitations would mean a minimum thickness of specimen of 0.219 in. when its Brinell value is 20, or a minimum thickness of 0.042 in. when its Brinell value is 100.

No change in the Brinell value of about 24, for annealed commercially pure wrought aluminum, is found when using the 500-kg. load, 10-mm. ball combination, until specimens somewhat less than 1/16 in. are tested. Again, this set of test conditions can be used without change in hardness values, on the harder alloys having Brinell values around 100, if the specimens are not less than 1/32 in. thick. It would appear, therefore, that for satisfactory results in the case of the wrought aluminum alloys, the thickness of Brinell specimens for the softer alloys needs to be but little, if any, more than twice the depth of impression, and for the harder alloys not more than five times the depth of impression.

Distortion Permissible

In making static indentation hardness tests on light metals, no differences in results are noticeable when either hard or soft steel anvils or specimen supports are used, provided the specimens are of suitable thickness, as previously indicated. When soft anvils of other metals are used effects can be observed, but since such supports are not ordinarily used or considered in commercial testing they will not be discussed further herein.

Another rule, which appears in the standard methods for Brinell hardness tests of metals, states that when the side of the specimen opposite the impression shows distortion caused by the impression, the results are questionable. In the case of light metals, however, considerable distortion can occur before there is any appreciable effect on the hardness values obtained.

The Brinell hardness values obtained in tests of light metals may be, and often are, appreciably affected by the surface conditions of the specimens used. Many of the light-metal products, such as common alloy sheet, bar and extruded shapes, have smooth, bright surfaces which require no additional

Table II—Comparison of Brinell Hardness Values and Rockwell "E" and "S" Scale Values for Wrought Aluminum Alloy

Brinell Hardness[a]	Rockwell Hardness[b] "E" Scale	"S" Scale
14	..	—30
15	..	—20
16	..	—10
18	..	0
19	..	10
20	..	20
22	..	30
25	..	40
27	..	50
28	2	52
29	7	55
30	11	58
31	15	61
32	18	63
33	22	65
34	25	68
35	28	70
36	31	72
37	33	73
38	36	75
39	38	77
40	41	78
41	43	80
42	45	81
43	47	83
44	49	84
45	51	85
46	52	87
47	54	88
48	56	89
49	57	90
50	59	91
51	60	92
52	61	93
53	63	94
54	64	94
55	65	95
56	66	96
57	67	97
58	68	98
59	69	98
60	70	99
61	71	100
62	72	100
63	73	..
64	74	..
65	75	..
70	79	..
75	82	..
80	85	..
85	88	..
90	90	..
95	92	..
100	94	..
105	96	..
110	98	..
115	99	..
120	100	..

[a] Based on 500-kg. load, 10-mm. ball, 30 sec.

[b] "E" scale—100-kg. major load, 1/8-in. ball (red or "B" scale).

"S" Scale—60-kg. major load, 1/8-in. ball (red or "B" scale).

Table III—Chemical Composition and Heat Treatment of Aluminum Alloys Used to Determine Creep Characteristics at High Temperatures

Alloy	Chemical Composition, Per Cent: Copper	Iron	Silicon	Magnesium	Nickel	Manganese	Solution Treatment[a]: Temp., Deg. F.	Solution Treatment[a]: Time, Hr.	Aging Treatment: Temp., Deg. F.	Aging Treatment: Time, Hr.
No. 1[b]	3.90	0.38	0.21	1.60	2.22	...	950	5	375	5
No. 1-A[c]	3.91	0.35	0.13	1.68	2.22	...	950	5	375	5
No. 2[b]	9.64	1.08	0.22	0.23	...	...	925	5	375	5
No. 3[b]	1.18	0.26	4.61	0.58	...	...	980	16	440	8
No. 4[b]	4.29	0.50	0.66	...	...	...	960	24	300	2
No. 5[c,d]	0.90	0.78	12.64	0.96	0.91	0.02	...	..	...	..
No. 6[c,d]	2.96	0.53	13.18	1.04	3.08	...	...	..	...	..
No. 7[c,d]	4.06	0.62	0.21	0.47	2.12	0.01	...	..	...	..
No. 8[b]	0.37	0.28	0.19	5.96	1.49	1.00	None	..	..	..

[a] Specimens quenched in cold water at conclusion of solution treatment.

[d] Cast alloys.

[c] Wrought alloys.

[b] Alloys supplied in heat-treated condition. Method of heat treatment was not reported.

treatment in order to make them suitable for hardness tests. Most sand castings and rough forgings, however, require additional surface preparation. For routine commercial inspection testing this is usually done by filing, scraping, or grinding. In some instances further finishing may be done by using fine emery cloth followed by buffing. The alloys that are heat treated have oxide coatings which are somewhat thicker than those on the cold-worked common alloys; and some of the products have comparatively thick anodic coatings, purposely applied electrolytically to obtain better corrosion resistance or paint adherence, or both. In the case of such products it is difficult to obtain satisfactory hardness determinations because if they are tested without removing the coating, variations in results may be obtained depending upon the load-penetrator combination used. Removal of the coating involves damage to the product unless a separate coupon is provided. The variations in hardness of two materials with different amounts of oxide coating are shown in Table 1. It may be noted that the greater variations occur when using the smaller penetrators and lighter loads. The type of Brinell impression obtained on anodically coated aluminum is shown by the enlarged photograph in Fig. 1. The radial cracks in the coating are quite typical.

In making the Brinell test it is usual practice to average the values obtained from two diameter measurements of the impression taken 90 deg. apart. In some instances, as shown in Fig. 2, Brinell, Rockwell and Vickers impressions are obtained which are appreciably out of shape. The distortions observed in practice may amount to as much as 15 per cent in the Brinell and Vickers values, yet such materials will exhibit but slight differences in their tensile properties in the various directions. In such instances any deductions concerning directional properties of the materials, based on the hardness tests, are likely to be quite misleading quantitatively.

The errors involved in making the Brinell test include a permissible testing machine load error of ± 3 per cent, an error in ball diameter which is usually negligible but may affect the results by ± 1 per cent, a diameter of impression

Table IV—Creep Rates of Aluminum Alloys

Alloy	Temp., Deg. F.	Load, Lb. per Sq. In.	Total Extension During Testing Period, In. per In.	Duration of Test, Hr.	Secondary Creep Rate, Per Cent per 1000 Hr.	Remarks
No. 1	400	2,500	0.000083	313	0.00	
	400	5,000	0.000124	312	0.01	
	400	10,000	0.000206	503	0.02	
	400	12,500	0.000388	532	0.05	
	400	15,000	0.000512	502	0.06	
	400	17,500	0.000735	460	0.12	
	400	20,000	0.001726	460	0.29	
	400	22,500	0.004078	293	...	Bar failed, 300 hr.
	600	1,300	0.000273	145	0.00	
	600	2,500	0.001651	293	0.28	
	600	3,400	0.003906	312	1.04	
	600	4,300	0.008777	267	...	
	600	5,000	0.017813	251	...	
No. 1-A	400	15,000	0.000875	556	0.11	
	400	20,000	0.010090	532	...	
	600	2,500	0.002688	317	0.69	
	600	5,000	0.042150	79	...	
No. 2	400	5,000	0.000322	511	0.01	
	400	10,000	0.000916	534	0.11	
	400	15,000	0.026033	668	...	Extensions at 506 hr., 0.010905 in. per in.
	400	20,000	0.012269	28	...	Bar failed, 28.5 hr.
	600	1,300	0.000644	383	0.12	
	600	1,900	0.001710	294	0.43	
	600	2,500	0.003310	312	0.99	
	600	3,400	0.019899	175	...	
	600	5,000	0.0740	47	...	
No. 3	400	5,000	0.000413	503	0.05	
	400	7,500	0.000570	579	0.07	
	400	10,000	0.000908	554	0.12	
	400	12,500	0.002312	486	0.17	
	400	15,000	0.006705	510	...	
	600	1,300	0.000602	245	0.15	
	600	1,900	0.001205	312	0.25	
	600	2,500	0.004640	310	1.38	
	600	3,400	0.020691	96	...	
No. 4	400	2,500	0.000355	509	0.04	
	400	5,000	0.000789	535	0.09	
	400	7,500	0.001164	484	0.14	
	400	10,000	0.004368	510	0.69	
	600	1,300	0.000654	308	0.13	
	600	1,900	0.001198	308	0.29	
	600	2,500	0.003798	308	...	
	600	3,400	0.015852	72	...	Bar failed, 75 hr.
No. 5	400	5,000	0.000520	578	0.06	
	400	7,500	0.000829	578	0.09	
	400	10,000	0.001246	578	0.15	
	400	15,000	0.011224	555	...	Extension at 508 hr., 0.008339 in. per in.
	600	1,300	0.000768	169	0.21	
	600	2,500	0.016071	266	...	
No. 6	400	7,500	0.000553	574	0.07	
	400	10,000	0.001445	788	0.14	
	400	15,000	0.016109	576	...	
	600	1,300	0.000950	291	0.22	
	600	1,900	0.003013	316	0.87	
	600	2,500	0.017090	340	...	
No. 7	400	2,500	0.000256	523	0.03	
	400	5,000	0.000603	576	0.09	
	400	7,500	0.000743	523	0.12	
	400	12,500	0.005260	557	...	
	600	1,300	0.001469	308	0.40	
	600	1,900	0.004029	311	1.17	
	600	2,500	0.025405	311	...	
No. 8	400	2,500	0.001132	600	0.15	
	400	5,000	0.003030	527	0.42	
	400	10,000	0.013953	269	...	
	600	1,300	0.003104	313	0.86	
	600	1,900	0.007803	311	2.09	
	600	2,500	0.018825	266	...	
	600	3,400	0.0495	71	...	Bar failed, 72 hr.

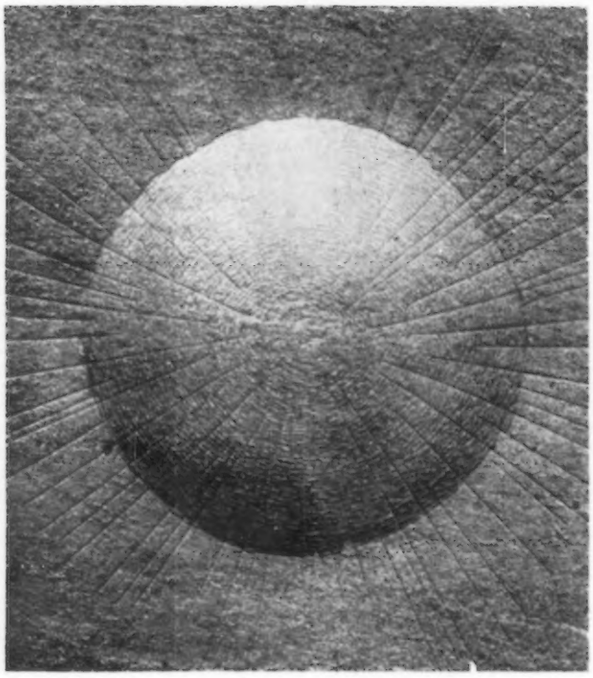


FIG. 1 — Enlarged photograph of a Brinell impression made on an anodically coated aluminum alloy sheet. The radial cracks in the coating are quite typical for this material.

measurement which is usually within ± 2 per cent and in routine commercial use, an error resulting from hasty manipulation of the test that probably amounts to ± 2 per cent in hand-operated machines. Thus these errors, which are often additive, may total as much as 8 per cent, but on the average will be within about ± 5 per cent. It is only fair to point out, however, that comparisons of Brinell hardness results from different commercial laboratories, using the same test specimens, have shown differences of as much as 15 per cent.

When using the smaller ball and load combinations for the Brinell test, it is necessary to use a compound filar microscope for measuring diameters of impressions. Such a microscope should permit estimation of diameters to within ± 0.002 mm. Under these conditions the making of Brinell hardness determinations is rather slow and expensive, with considerable opportunity for errors in manipulation.

The Rockwell test may be defined essentially as the difference in depth between an initial indentation caused by a primary load (10 kg.) and a final indentation resulting from a larger secondary or major load, while the penetrator is held in the final indentation by the primary load. In commercial practice quite a variety of loads and penetrators are used. Those generally recognized for use in testing light metals include a major load of 100 kg. on a ⅛-in. diameter steel ball with hardness values determined on the red scale of the dial (designated as the Rockwell "E" scale hardness); and a major load of 60 kg. on a ⅛-in. steel ball using the same scale (designated as the Rockwell "S" scale hardness). The latter of these scales is not recognized in the Testing Society's tentative methods of Rockwell hardness testing of metallic materials (E 18-33 T). An approximate comparison of the hardness values obtained on light metals using these two sets of test conditions with the standard Brinell test values is given in Table 2. The relationships may be expressed by the following equations:

$$B.H.N. = \frac{3570}{130\text{-}R_e}$$

and

$$B.H.N. = \frac{2460}{140\text{-}R_s}$$

Where $B.H.N.$ = Brinell hardness, R_e is the Rockwell hardness on the "E" scale, and R_s is the Rockwell hardness on the "S" scale.

From what has been pointed out in discussing the Brinell test concerning limitations of specimen thickness and depth of impression, and the load-ball size conditions of the Rockwell "E" and "S" scales, it may be seen that these two Rockwell hardness scales will cover about the same range of thickness for light-metal products as that which may be satisfactorily tested with the different Brinell ball sizes, 1/16 in. in diameter and larger.

The Rockwell test is more readily carried out than either the Brinell or Vickers and probably involves less personal equation. In attempting to use the test in the commercial inspection of light metals, however, considerable difficulties have been encountered. These in-

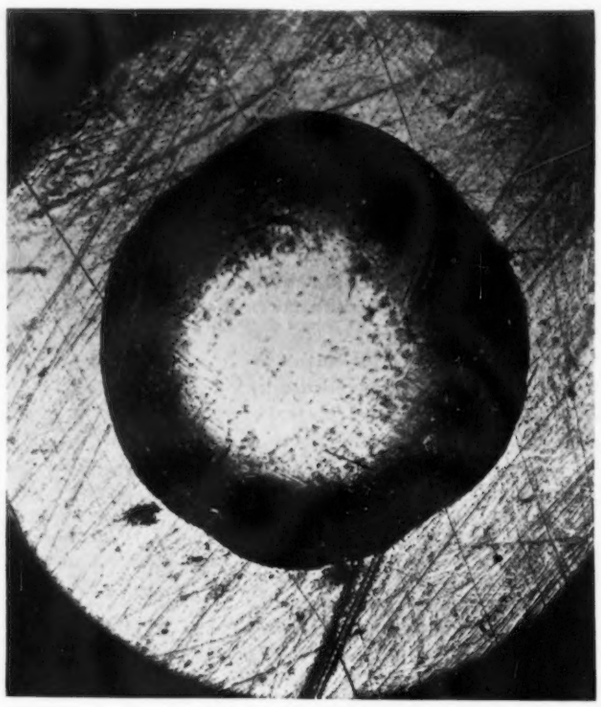


FIG. 2 — An enlarged view of a distorted Brinell impression as obtained on certain aluminum products. Such a distortion may amount to as much as 15 per cent in the Brinell and Vickers values, yet the material will exhibit but slight differences in tensile properties in the various directions.

clude troubles in calibration and maintenance of machines, erroneous or insufficient designation of hardness values recorded, reading wrong scale on dial, and use of wrong load or penetrator in machines equipped for various combinations of these. A mistake frequently made in attempting to test thin specimens is to superimpose a number of thin specimens. This leads to erratic results. Near the lower ends of the Rockwell hardness scales suitable for use on light metals, quite large variations can be obtained in values, which have relatively little significance if the tensile properties are used as an index of the quality of product. Near the upper ends of the scales the opposite is true. As in the case of the use of the smaller Brinell balls, for satisfactory results the Rockwell test will generally require more careful surface preparation of the specimens than when using the larger balls in the Brinell test.

Vickers Test

In the Vickers test the penetrator used is a square diamond pyramid having a total included angle of 136 deg. The values for hardness are obtained by dividing the load (in kilograms) by the surface area of the impression (in square millimeters). Throughout the range of loads generally used the hardness values are constant, which offers a distinct advantage over the Brinell and Rockwell tests, and the loads can be varied to suit both the hardness and thickness of the specimens without change in penetrator. When using the smaller loads, from 1 to 15 kg., however, it is necessary to use the more accurate filar microscope, as in the case of the "baby" Brinell test.

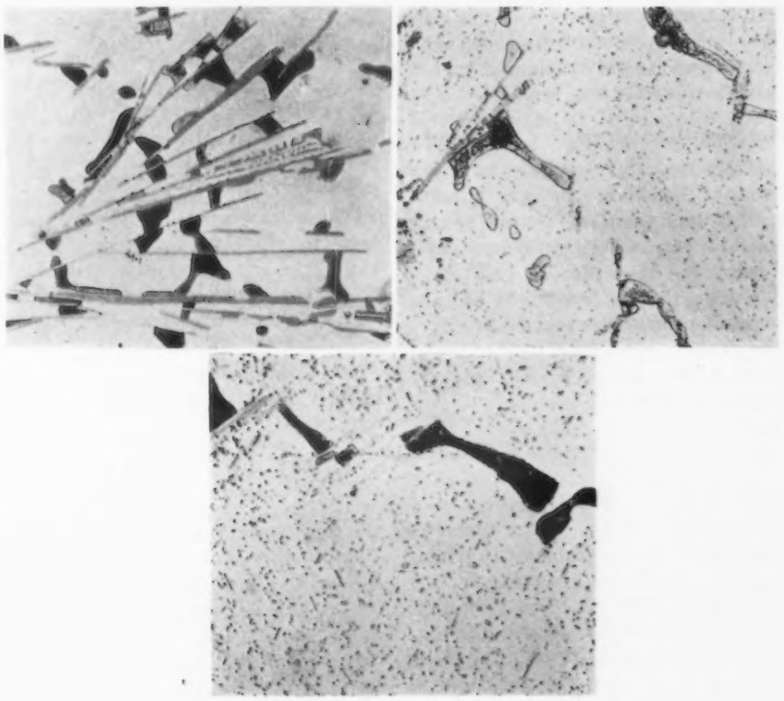
The limitations regarding specimen thickness are apparently somewhat less severe for the Vickers than for the Brinell test and, therefore, cause little trouble in tests of light metals. In practice the Vickers test can be made in about the same time as is required for the Brinell test. The impressions obtained are easier to measure because of their square shape, the diagonals only being measured. Distorted impressions, however, occur as in the Brinell test. On the whole, the errors in the Vickers test are probably somewhat less than in the Brinell test.

In the Shore or scleroscope hardness test a small hammer weighing about 2.4 gm. is dropped from a height of about 10 in. on the specimen, and the height of rebound is observed on an arbitrary scale of 140 divisions = 10 in. (model C or indicating type). Another form of the instrument (type D) uses a much heavier hammer which drops about ¾ in. In this case the hammer is caught by a suitable mechanism at its maximum height of rebound and the height recorded on a dial scale graduated into 140 divisions, so that readings are obtained which agree more or less with those obtained with the indicating or type C instrument. Both instruments are provided with hard steel anvils or specimen supports and a clamping arrangement to hold the specimens firmly in position while being tested.

In both types of the scleroscope it is necessary to use the magnifier hammer for satisfactory results on the light metals. These hammers may be furnished with either hardened steel or diamond points, and in either case have larger radii of curvature than the "universal" diamond-pointed hammers. Unfortunately, much trouble has been experienced in obtaining magnifier hammers that will check similar hammers in other instruments of the same type. In England, largely as the result of investigation by Genders, a magnifier hammer for the indicating type of instrument has been adopted which apparently gives quite concordant results and can be rather easily maintained within the desired limits of accuracy. In this country, however, there are a large number of scleroscopes in use with magnifier hammers that give quite discordant results on the light metals, thus making it very difficult, if not impossible, to obtain satisfactory check results among the users of these instruments.

Limitations concerning thickness of specimen are somewhat more severe in the use of the scleroscope than with the other hardness tests discussed. For both the softer and harder materials the scleroscope readings are affected when the specimens are less than about 1/16 in. thick. With the scleroscope test, of course, no change in hammer

FIG. 3—Structure of cast aluminum alloy (9.64 copper, 1.08 iron, 0.22 silicon, and 0.23 magnesium) as heat treated (upper left), after creep testing for 500 hr. at 400 deg. F. (upper right), and after creep testing for 300 hr. at 600 deg. F. (bottom). All views at 500 diameters. The rapid growth of precipitate particles in the lower view is to be expected as the 600-deg. temperature is in the annealing range.



size can be made, while in the static penetration tests the conditions can be altered to satisfactorily test appreciably thinner specimens. As in the case of the Rockwell test, attempts are frequently made to test thin specimens with the scleroscope by superimposing a number of thin specimens on each other. Experience shows that a different hardness value is usually obtained with the addition of each piece. The personal errors involved in reading and manipulating the scleroscope are often large in the case of the indicating type.

In spite of the difficulties just noted, the scleroscope can be and is used to good advantage in certain routine inspection tests in controlling some fabrication operations. It has not been considered satisfactory, however, as a final test for acceptance or rejection of light-metal products and should not, therefore, be considered as a suitable specification test.

Hardness and Strength Compared

Many metals, especially in the wrought condition, exhibit a rather definite and usually simple relationship between their Brinell or Vickers hardness values and tensile strength. The wrought aluminum alloys are no exception to this. The tensile strength-Brinell relationship may be expressed by the simple equation:

$$\text{B.H.N.} = \frac{T}{575}$$

where *B.H.N.* is the Brinell hardness number, and T is the tensile strength in lb. per sq. in. In giving this equation, however, it is appreciated that there is a definite minimum Brinell hardness number possible, corresponding to that obtained with an impression equal to the diameter of the ball used. This minimum value is not zero, as indicated by the equation just given, but the errors resulting are negligible in most instances, and in the interest of simplification have been ignored.

Unfortunately, the procedure too often followed is to try to determine the tensile strength of a product from a Brinell test and the relationship just indicated. In doing so the errors involved in the Brinell determinations are multiplied 575 times, with the result that the values for tensile strength obtained by this procedure may be very much in error. *On the other hand, if we know the tensile strength of the material, the Brinell hardness can be calculated from the equation given, with a very satisfactory degree of accuracy.* A similar relationship for Vickers hardness and tensile strength can be worked out with the same pertinent limitations.

The relationship between Brinell and Rockwell hardness for aluminum alloys was given previously. The comparison in this instance is rather complex and in practice generally results in the use of a table rather than the equations given. The relationship between tensile strength and Rockwell hardness is likewise rather complex, and may be expressed as follows:

$$T = \frac{2{,}020{,}000}{(130\text{-R}_c)}$$

and

$$T = \frac{1{,}320{,}000}{(140\text{-R}_c)}$$

The constants in these equations are quite large and their numerical accuracy rather questionable. In general form, the equations are quite in agreement with those proposed by Petrenko.

The scleroscope hardness values seem to correlate better with the yield strengths of the light metals than with the tensile strength values, although there is but little more scatter in the latter case. These relationships may be approximately represented by the following equations:

$$S = \frac{Y}{1320} \text{ and } S = \frac{T}{1775}$$

where S is the scleroscope hardness (magnifier hammer), Y is the yield strength, 0.2 per cent set, lb. per sq. in., and T is the tensile strength in lb. per sq. in. Here, as in the case of the Brinell relationship, it is quite unsatisfactory to attempt to determine the tensile strength or yield strength from a scleroscope value; but knowing the value of tensile strength or yield strength, the scleroscope hardness can be estimated rather closely from the equations given.

As a conclusion, Mr. Templin pointed out that the Brinell test, especially the 1000-kg. load, 9/16-in. ball combination, is quite extensively used as a 100 per cent final inspection test on aluminum pistons, made as forgings, sand castings, or permanent-mold castings. This test is also used as a check on the heat treatment of many other light-alloy products in both the wrought and cast condition. The Vickers test has so far been used to little extent in the light-metal field in this country. While both the Rockwell and scleroscope tests have been used to considerable extent in testing light-metal products, yet for reasons discussed their use in product specifications would appear quite unsatisfactory. In general, experience has shown the tension test to be quite preferable to any of the hardness tests, when the form and size of product permit of its use. From tension test values of light metals in the wrought condition, the various hardness values can be computed with satisfactory results, using the relationships given.

Creep of Aluminum Alloys

Aluminum alloys are used in a variety of applications in which they are exposed to elevated temperatures. The short-time tensile properties at these temperatures have been studied by a number of investigators, but little attention has been paid to the long-time tensile properties or creep characteristics. Therefore the report on Thursday by R. R. Kennedy of the United States Army Air Corps on the long-time creep characteristics of aluminum alloys was most timely.

Mr. Kennedy selected nine aluminum alloys for investigation which have been proposed for use at elevated temperatures. The creep characteristics of these alloys were determined at 400 and 600 deg. F. He found that the creep rates of these alloys varied over a wide range. A sand-cast aluminum-copper-nickel-magnesium alloy had the best creep characteristics of the alloys tested. Some of the newer wrought and cast alloys were markedly inferior to this alloy in that respect, although their mechanical properties at room temperature were superior in some cases and they had better casting and forging properties.

In his report Mr. Kennedy stated that metals are today employed in many structures which operate at temperatures much higher than atmospheric, so an accurate knowledge of the mechanical properties of these metals at operating temperatures is of prime importance. The results of short-time tension tests have been of value, but metals may fail at elevated temperatures when stressed to values which might be considered safe when only the short-time tensile proper-

ties are considered. Familiarity with the long-time tensile properties or creep characteristics of metals is of value if structures are to operate at elevated temperatures without danger of failure and at the same time without the use of excessive amounts of material.

As the ferrous metals are most widely used in high-temperature installations, the creep characteristics of numerous ferrous alloys have been determined. The aluminum alloys have not been so thoroughly investigated, though a few tests have been reported. Due to their relatively low melting points, aluminum alloys are not suitable for use under stress at temperatures much higher than 600 deg. F. At lower temperatures, aluminum alloys find wide application in installations such as internal combustion engines, where light weight and high heat conductivity are of advantage.

It has been shown that the strength of aluminum alloys at elevated temperatures, as determined by short-time tests, is lowered as the time of heating before testing is increased. This change in tensile strength takes place rapidly during the early part of the heating cycle and then much more slowly, but a period of months is sometimes required before complete stability is attained. It was considered desirable to heat specimens for creep tests through the period of rapid change of mechanical properties before the load was applied, but the period of heating was not long enough to produce complete stability. Therefore, when the results of creep tests are compared with those of short-time tests, it should be remembered that the short-time properties are not constant, but would be lower at the end of a long-time test than at the beginning. In determining the creep characteristics of aluminum alloys for use in structures which would be expected to operate for a period of years at elevated temperatures, the use of specimens which had been completely stabilized at testing temperatures might be desirable. This investigation was conducted, however, with reference to aluminum alloys for use in aircraft engines. A military engine has a life in the neighborhood of 1000 flying hours. Commercial engines may be operated for somewhat longer periods, but in no case is the life comparable with that of such structures as steam boilers, which must operate for years without failure. The long-time test should indicate the creep characteristics of alloys during the life of an airplane engine.

Table V—Hardness of Aluminum Alloys After Creep Tests

Alloy	Temp. of Test, Deg. F.	Duration of Test Prior to Hardness Testing, Hr.	Brinell Hardness, 500 Kg. Load
No. 1....	400	503	96
	600	293	54
No. 1A...	400	556	105
	600	317	60
No. 2....	400	511	91
	600	264	53
No. 3....	400	503	67
	600	246	39
No. 4....	400	509	74
	600	308	46
No. 5....	400	578	75
	600	308	49
No. 6....	400	574	79
	600	291	60
No. 7....	400	576	49
	600	311	44
No. 8....	400	527	81
	600	313	76

The maximum temperatures to which aluminum alloy aircraft engine parts are subjected ranges from 450 deg. F. for liquid-cooled cylinder heads to 650 deg. F. for pistons. In this investigation the creep characteristics of the alloys were determined at 400 deg. F. and at 600 deg. F., the lower temperature representing normal operating conditions and the higher temperature representing extreme conditions. Specimens for long-time tests at 400 deg. F. were stabilized for 68 hr., while those for tests at 600 deg. F. were stabilized for 20 hr. at testing temperature before the tests were started. Short-time tests at the same temperatures were run on certain of the alloys. The specimens for these tests were given the same stabilizing treatments as the creep test specimens, so the short-time properties reported represent the strength of the alloys at the time when creep tests were started.

Nine Alloys Tested

A list of the alloys used is given in Table III, with the chemical composition of each. The method of heat treatment is given in cases where it was known. Some of the alloys, such as Nos. 1 and 2, have been used for a long period under exacting conditions at elevated temperatures. Others are later developments, while some have not as yet gained acceptance. The list includes most of the alloys used at elevated temperatures in American practice.

The results of long-time or creep tests are given in Table IV. Tests were run for 300 hr. at 600 deg. F. and for 500 hr. at 400 deg. F. The total extension over the entire testing period is reported in inches per inch. The extension during the secondary period is report as creep rate per 1000 hr. or the period of time considered to be the service life of a military aircraft engine. The creep rate is not reported in cases where the specimen was rapidly extending toward the close of the testing period and would probably have failed in less than 1000 hr.

Marked differences were observed in the mechanical properties of the alloys as determined by short-time tests. Data which have been determined indicate that at room temperature the wrought alloys (Nos. 1-A, 5, 6 and 7) had much higher tensile strength and ductility than the cast alloys (Nos. 1, 2, 3, 4 and 8). In short-time tests at 400 deg. F. the wrought alloys showed a greater drop in tensile strength than the cast alloys, though wrought alloys Nos. 1-A and 5 were stronger than the cast alloys. Wrought alloys Nos. 6 and 7 were heated for long periods before testing, so the results are not comparable. At 600 deg. F. the strength of all alloys was greatly reduced as compared with the properties at room temperature. Cast alloy No. 1 (4 per cent copper, 2 per cent nickel, 1.5 per cent magnesium) had the highest tensile strength.

The creep rates of the alloys varied over a wide range. The rate of extension at 600 deg. F. was much more rapid than at 400 deg. F., as would be expected. Cast alloy No. 1 had the best creep characteristics of the alloys tested, both at 400 and at 600 deg. F. Alloy No. 1-A had the same chemical composition as alloy No. 1, but was forged into the form of a bar. The forged alloy specimens had appreciably higher creep rates than the cast alloy in the test runs. Unfortunately, only a few specimens of the forged alloy were available, *but the results indicate that hot working with its consequent grain re-*

(CONTINUED ON PAGE 66)

Improvements in Production

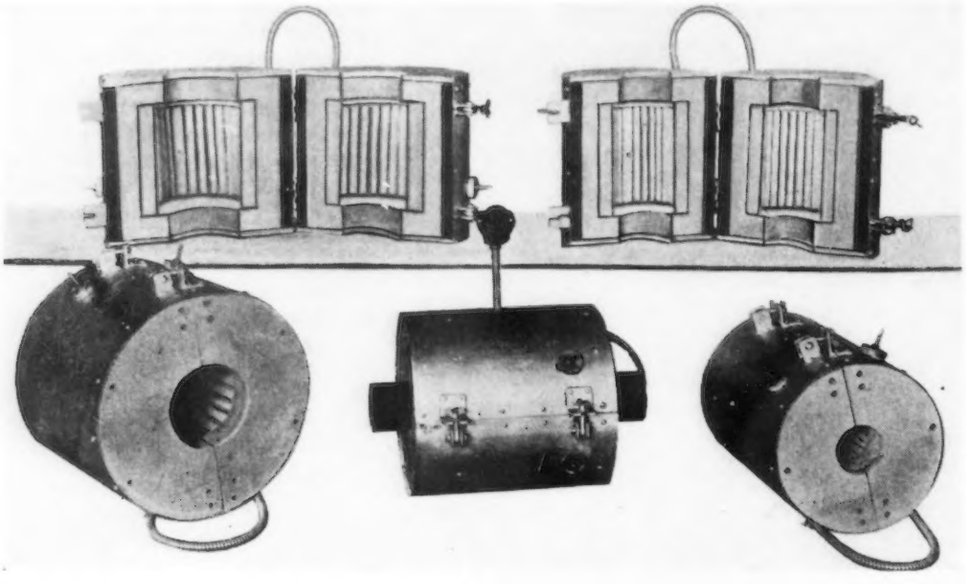
Welds Stress-Relieved by Portable Electric Heaters

FOR local stress relieving of welded seams in high-pressure piping, etc., and for stress relieving nozzle welds, H. O. Swoboda, Inc., Pittsburgh, has placed on the market the two new Falcon portable electric heaters shown in the accompanying illustrations.

Development of this new equipment follows that of the Falcon electric heaters for local stress relieving of longitudinal and circumferential welded seams in large pipes, penstocks, pressure vessels, etc., and the more recent development of another type of heater, also for field use, for the simultaneous stress relieving of one circumferential and four longitudinal seams in penstocks as large as 20 ft. in diameter, 20 ft. in length and 1⅜ in. thick.

The cylindrical type unit is shown in Fig. below. It consists of two semicircular heating units and includes heat insulation, refractory plates, nickel-chromium heating elements and plug-type terminals with plugs for portable cable attachment. The refractories are backed by solid heat insulation around the sides, and similar insulation is provided on each end. The heater, together with its insulation, is assembled in sheet steel casing having high-temperature insulating board ends.

Hinges are provided so that the heater can be opened up for mounting around the pipe joints. Wing bolts are supplied for keeping the heater tightly clamped around the



ELEVATION views, at left, of cylindrical type unit, showing face of heaters with removable ends, heater clamped around pipe and plug-type terminals for portable connections.

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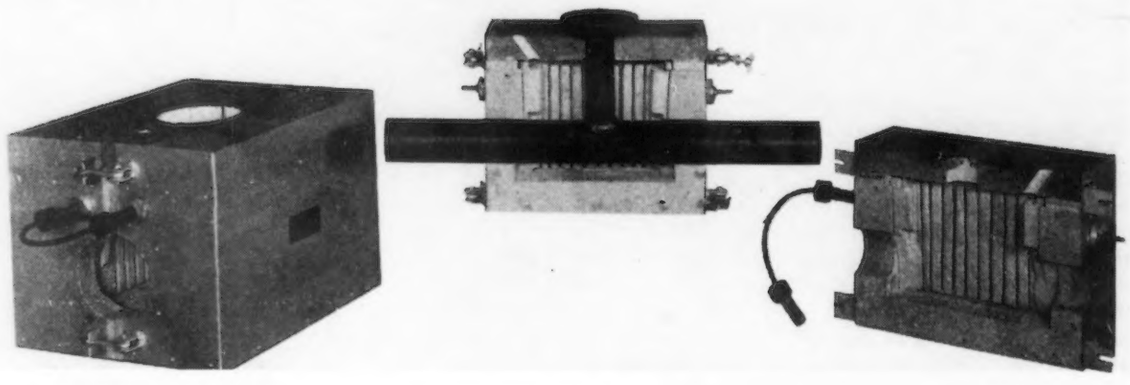
ELEVATION views, below, showing face of nozzle weld stress relieving heaters, thermocouple opening and method of installing heater over nozzle weld.



pipe while stress relieving. A thermocouple opening is provided in the side of the heater through the heat insulation and refractory plate of the heating unit for reading the temperature of the pipe.

One size of unit can be used for several pipe sizes. A heater for stress relieving 4-in. pipe can be used, for example, on 1½, 2 and 3-in. pipe as well. This is accomplished by inserting refractory bushings into the ends of the heater for each of the smaller sizes so that they will fit snugly around each pipe size. In addition, the end heat insulation is removable so that the heaters can be used for stress relieving the welds of pipebends.

The heating area of the units is of such length that the weld and a certain specified distance on each side of the weld are slowly raised to a temperature of 1200 deg. F. Heater capacities are such that the pipe can be raised to temperature in a specified time. A heater of 6.5-kw. capacity, for example, is sufficient to raise the temperature of a 4-in. steel pipe of 0.337 in. maximum thickness up to 1200 deg. F. in about ¾ hr. from 70 deg. F. when starting with the heater cold. After the heater has been thoroughly heat saturated, the time of stress relieving succeeding welds is reduced to about 20 min. Through suitable control equipment the pipe can be held as long as desired at the stress-relieving temperature and then allowed to cool.

These cylindrical type units are supplied for stress relieving pipe up to 8 in. in diameter. For larger sizes of pipe the heaters are built in the form of segments, three or more, for strapping around the pipe. For large pipe, penstocks, pressure vessels, etc., another type of unit is available.

The nozzle heaters are shown at left. These consist of two sections, each arranged for clamping

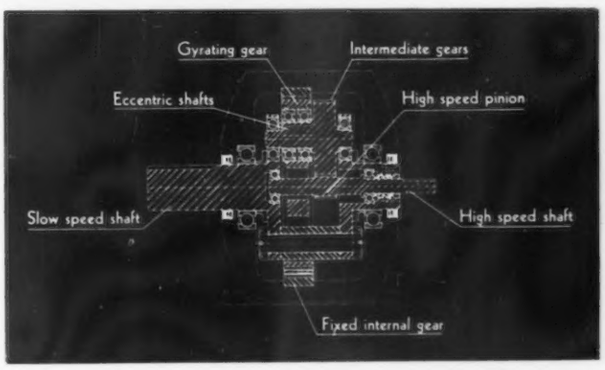
(CONTINUED ON PAGE 67)

Gyrating Gear Speed Reducer Gives 180 to 1 Reduction in Single Stage

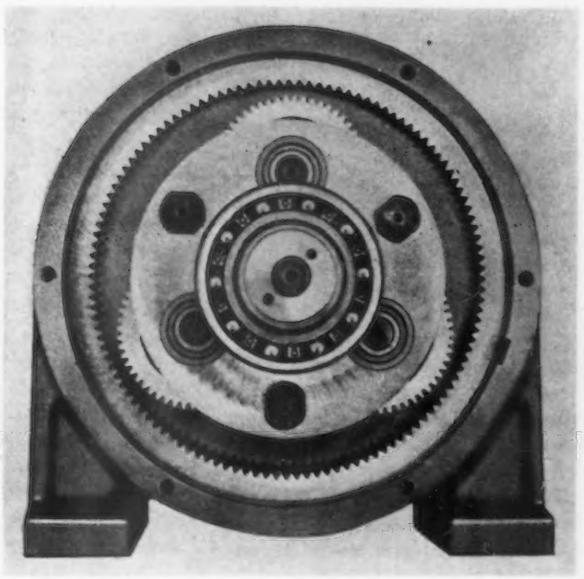
SPEED reducers incorporating a compact gear mechanism giving any ratio from 4 to 1 up to 180 to 1 in a single stage are being marketed by the S-B Gear Corpn., 640 West Fifty-eighth Street, New York. Motorized units, both horizontal and vertical, with electric motor built integral are also offered.

Planetary gearing is used in the reducers for ratios below 20 to 1 and a gyrating type of gearing for ratios above 20 to 1. With the gyrating type gear, ratios up to 180 to 1 can be obtained with a single reduction; in addition to this maximum reduction in a single stage, compactness and high efficiency are featured. Gear ratios up to 14,400 to 1 can be obtained with a double stage of gearing, and up to 1,728,000 to 1 with a triple stage.

Arrangement of the gyrating-gear type unit is shown in the ac-



ARRANGEMENT of the gyrating - gear type unit is illustrated in the line sketch at the left.



PLANETARY gearing is used in these speed reducers for ratios below 20 to 1. A gyrating type of gearing is employed for higher ratios. Ratios up to 14,400 to 1 can be obtained with a double stage of gearing and up to 1,728,000 to 1 with a triple stage.

companying line sketch. The high-speed pinion drives three intermediate gears, which are integral with eccentric shafts. The eccentrics support the gyrating gear which meshes with a fixed internal gear. The rotation of the eccentrics causes the gyrating gear to roll within the fixed internal gear, and this rolling motion causes a slow forward rotation of the gyrating gear which for each revolution of the eccentrics is equal to the difference in number of teeth in the gyrating gear and in the internal gear. This slow rotation of the gyrating gear reacts through the eccentrics to cause the slow speed shaft to revolve. Many different ratios can be obtained through variation of the amount of eccentricity of the eccentric shafts and through change of ratio between the high-speed pinion and the intermediate gears.

In reduction units above 1 hp., two gyrating gears of the same size are employed in order to distribute the load over a wider tooth bearing surface. Twenty per cent of the teeth of the gyrating gear are always in mesh, and at least four teeth are completely in mesh. These reducers are built in capacities ranging from ½ to 50 hp., both horizontal and vertical.

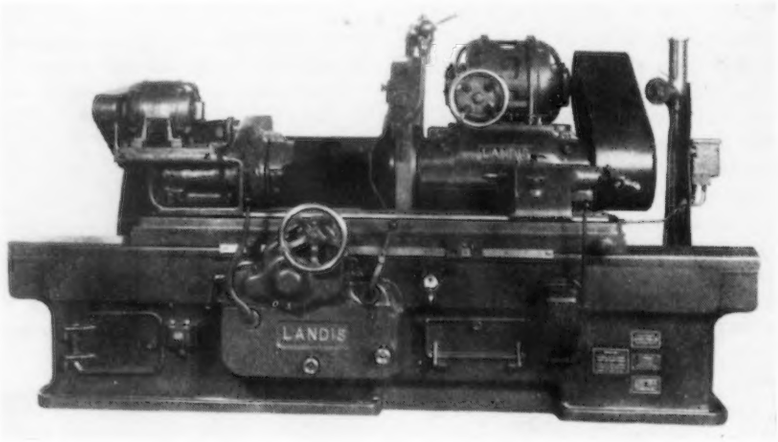
All parts are made of heat-treated alloys and are machined to close tolerances. All parts are designed for a very high factor of safety which permits 24-hr. operation at maximum rated loading and momentary 150 per cent overloads. Precision ball bearings are used throughout, and ample lubrication is provided at all times without churning. The reducers are completely sealed against oil leakage.

"Korolac" Coating for Plating Tank Use

A NEW coating, both corrosive-resistant and non-contaminating, for plating racks, is announced by the B. F. Goodrich Co., Akron, Ohio. Designated as "Korolac," the coating is said to possess high dielectric resistance, to be translucent, tough and inert. Immersion tests indicate that it is not affected by those solutions ordinarily employed in plating baths for chrome, nickel, cadmium, zinc, copper, brass, silver, tin and other materials. At normal temperatures, Korolac is a jelly-like material, but when heated it becomes liquid. When cooled it shrinks, seizes the metal and holds its position.

Hydraulic Grinder Design Embodies Minimum Spindle Clearance

LARGE, type D, plain hydraulic grinders with 10-14 and 16-in. swings, and length capacities of 18-36-48 and 72 in. are built by Landis Tool Co., Waynesboro, Pa. Constant speed motors of 20 or 25 hp. are used for the wheel drive; the pump is driven by a 3 hp. motor and the work motor may be either 1 or 1½ hp., depending upon the swing. End wheel-spindle drive through multiple V-belts is employed. In order that there may be required the least possible wheel spindle clearance, flood-lubricated, cap type, babbitt-lined steel, wheel spindle bearings are used. The standard wheel is 30 in. in diameter. Provision is made for larger diameters, particularly for use in grinding crankshaft line bearings.



A dual hydraulic system provides a wide range of work table speeds between 6 and 240 in. per min. Table speeds are regulated by a convenient valve governing the flow from the end of one cylinder to the corresponding end of the other. Hydraulic straight infeed is available for straight infeed grinding operations such as crankshaft line bearings, multiple wheel grinding and the greater part of side wheel grinding. Final work drive to the face-plate is through multiple V-belts.

The work-line center of the 10-in. machine is 36 in. from the floor; that of the 14-in. machine is 38 in. and of the 16-in., 39 in. These are convenient working heights.

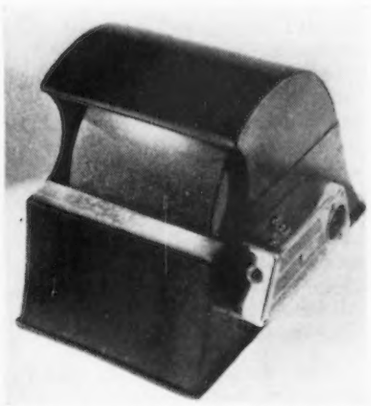
Various hydraulic controls are at the front of the bed and have a single cover. The pump drive is at the rear. The wheel spindle drive, mounted on a massive wheel base, and the entire wheel mechanism assembly have single covers. The maker stresses these conveniences of operation.

Portable Surfacing and Polishing Machine

A NEW portable surfacer and polisher, said to be fast and efficient in the removal of burrs and in the cleaning and finishing of castings, is being marketed by Trimson Mfg. Co., Cleveland. The device is illustrated on page 31. A concealed light, within the cover housing, directly illuminates the work without any glare effect. The lip of the cover housing also affords a hand grip for carrying the machine from job to job. The company provides a special motor, described as follows: Location, within the drum; dustproof, dynamically balanced and rotates in grease-sealed ball bearings. The motor is hung in a rigid metal chassis, cushioned in rubber and

inclosed in a safety steel housing. Two sizes, ¾ hp. and 1 hp., are available.

A rotating drum, 7 in. diameter x 6 in. long, has a cushioned surface over which abrasive and polishing sheets are used; a few seconds only are required for change. In addition to use on metal surfaces, materials such as wood,



bakelite, carbon, fiber and hard rubber have been thoroughly demonstrated. Among other shop uses are specified chamfering carbon brushes, sanding patterns and sharpening tools. The machine weighs 50 lb., is 14½ in. long, 10 in. wide and 10½ in. high.

Hydraulic-Variable Speed Transmissions

EXTREME flexibility, accurately controlled, is specified for a new hydraulic variable speed transmission announced by Vickers, Inc., 1409 Oakman Boulevard, Detroit. The equipment is shown below. Speed range from 5 to 750 r.p.m. is available through hand wheel. The equipment assembly is compact and self-contained, there being no exposed pipes or working parts. Direct connected, 1200 r.p.m. motor is employed. Each power shaft end can be provided for rotation in either direction and mechanism for instantaneous change of direction is available. Power required is always at minimum, as torque is automatically controlled and there is no throttling or bypassing of the oil. Stock sizes have maximum output of 6 hp. continuous duty at 1000 lb. per sq. in., and 7½ hp. intermittent service at 1250 lb. per sq. in. Overall dimensions are not confined to specific figures, but may be varied to meet peculiar or unusual conditions. Remote control can be used.

Universal Tool Grinder Has Increased Facilities

THE Cincinnati No. 2 plain and universal cutter and tool sharpening machine, built by the Cincinnati Milling Machine Co., Cincinnati, has been improved by the adoption of a solid and heavier table slide and by the addition of duplicate operating control from the rear left side. The machine is shown below.

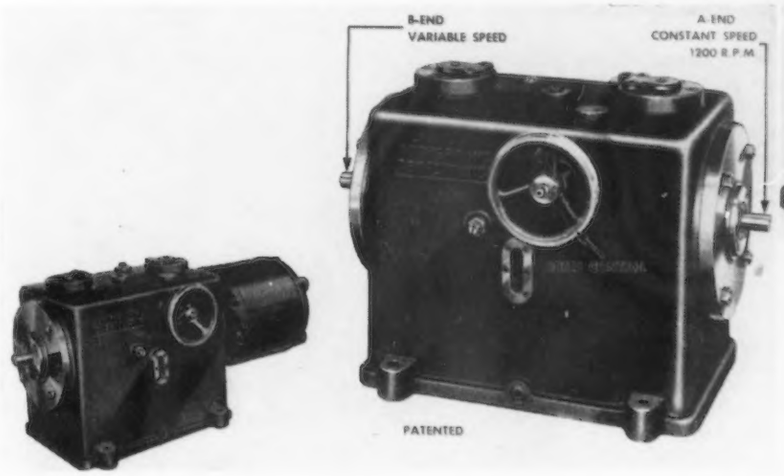
In the grinding of large rotary cutters the solid and heavier table slide reduces vibration to a minimum, resulting in a truer and more even cutting edge. The solid table also permits heavy loading when the table is displaced angularly as in the grinding of dovetail milling cutters.

The addition of left hand operating controls increases flexibility. Regardless of the type of work, the machine affords a normal operating position, and retains such desirable features as correct location of the work and tooth rest with respect to the right approach to the grinding wheel, unlimited visibility of the work and grinding wheel, accessibility to make changes in the setup and to true the grinding wheel without leaving the operating position.

No operating activity is in dangerous proximity of the grinding wheel. The grinding of left-hand milling cutters and spiral reamers is handled from the left-hand side of machine when facing the machine from the rear.

BELOW

HANDWHEEL controls the variation of speed between range points from 5 to 750 r.p.m. in the type of transmissions described at the left and shown below.



ABOVE

SOLID and heavier table slide, and duplicate operating control from the rear left side, facing the machine from the rear, have been adopted by the makers of these plain and universal cutter and tool sharpeners.

Non-Porous Steel Developed For Cold-Header Dies

By GEORGE EHRNSTROM, JR.
Pittsburgh Editor, The Iron Age.

A NON-POROUS steel has been developed by the Jessop Steel Co. to meet severe service conditions to which cold-header dies for forming the heads of bolts, screws, rivets and of other small metal products are subjected. The company's extensive research to produce a homogeneous die steel led to the discovery of a method which makes possible the separation and removal of the center section of the ingot in which inclusions and segregations have a tendency to concentrate.

Use of improved methods of pouring and cooling of ingots played an important part in the development of the non-porous steel. Close supervision was necessary to prevent slag produced in the melting operation from mixing with the steel. It is common knowledge that slag is lighter than metal and will rise to the surface by its own buoyancy. But when slag forms in extremely small particles, it might not have sufficient force to push through the viscous hot metal and will have a tendency to be trapped mainly in the center of the ingot. Moreover, slag inclusions separate the crystals of the steel and form points of weakness. Molten steel also is well known to contain some dissolved gases. The careful melting and deoxidation employed by the Jessop company removes these gases to a degree that assures a sound steel free from trapped gases which cause blow holes. Blow holes may be quite large or so minute that they cannot be detected without the aid of a microscope.

Any defects that, in minor amounts, would cause no trouble in ordinary steel will seriously affect the life of a header die. Segregation, inclusions or infinitesimal blow holes will cause minute ruptures in the surface, which soon

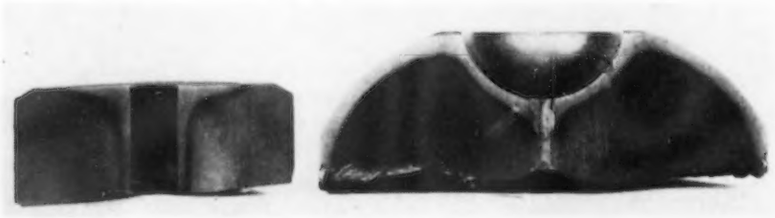


FIG. 1—The 3/8-in. rivet die at the left and the 3/4-in. button header at the right were broken to show the uniformity of the hardened surface. The crack shown in the header was made in breaking.

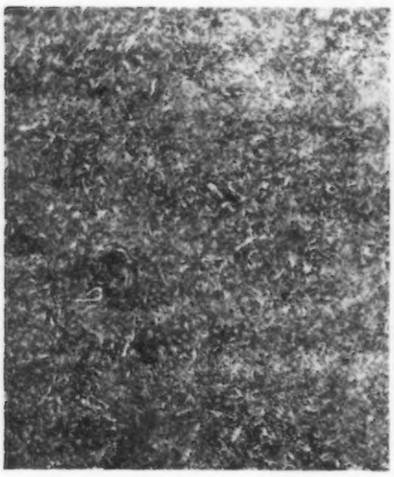


FIG. 2—Photomicrograph of hardened case.

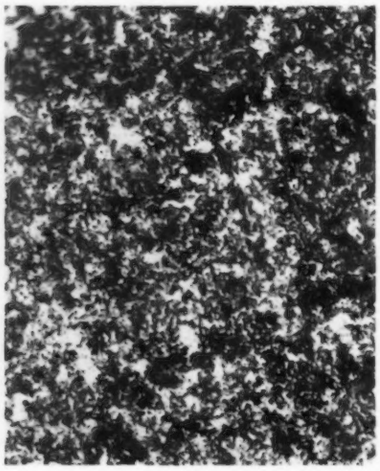


FIG. 3—Photomicrograph of core after heat treatment.

FIG. 5—A 5/8-in. cone header for making bolts.

FIG. 4—A header, left, and die, right, used in making screws from 0.115-0.116-in. brass wire. The header was in use 63 hours; it headed and slotted screws at the rate of 7500 an hour.

will result in spalling and cracking, with consequent die failure. Such failures mean losses in material and production time and an increase in heavy die expense.

The cold-header steels developed by the Jessop company are water-hardening carbon and carbon vanadium steel, with correct depth hardening characteristics. Proper heat treatment, which varies according to size and shape and also the material to be headed, will give to the dies and headers the proper case depth of hardness. This factor is important, as a too shallow hardened steel will cause sinking of both dies and headers, and if the steel is hardened to too great a depth, cracks will occur more readily in service. Fig. 1 illustrates a die and header broken for test purposes, showing the uniformity of the hardened surface. Figs. 2 and 3 are photomicrographs of typical structures of the two parts. These illustrations show the uniformity of the structure and the absence of segregation and slag inclusions, all of which are of primary importance in cold-header steel.

As the microstructure of the hardened steel depends to some extent upon the temperatures at which the steel has been rolled as well as annealed, extreme care is exercised to control the heating and rolling of this Jessop's die steel so that the final structure will be suitable for the hardening practice recommended for various types of tools and materials which they produce.

Dies and headers made from this steel have produced some unusual records. The header shown in Fig. 4 headed and slotted 472,500 screws from 0.115 to 0.116 in. brass wire at the rate of 7500 pieces an hour. The header lasted 63 hours. In the die, approximately 345,000 pieces were made in the same machine. Several screws are shown in the same illustration. Fig. 5 illustrates a cone header die which showed a 25 per cent increase over the steel previously used.

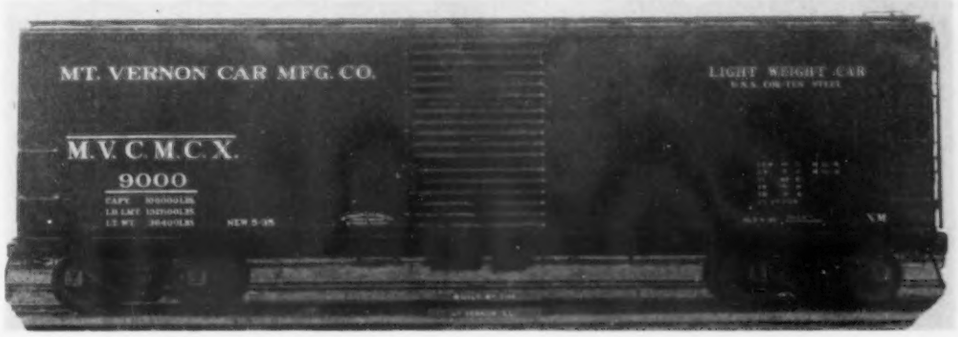
Since severity of service governs largely the number of pieces which can be made from a die, care should be exercised in comparing operating results. Bolts with square shoulders under the head are more difficult to head than without shoulders. A button shaped head shows a larger production than a cone shaped head. The easier the shape for the metal to flow to fill the die, the less severe the service. This offers a wide range for the initiative of the designer, who may vary the stock size, number of operations and the shape of each die as well as the sequence of the operations.

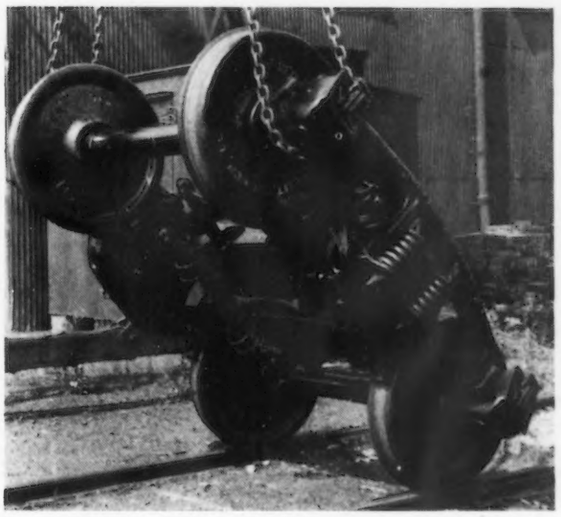
Light-Weight Box Car Is Built of High-Tensile Steels

THE Mount Vernon Car Mfg. Co., Mount Vernon, Ill., has completed a light-weight 50-ton steel sheathed box car along conventional lines of A.R.A. 1932 design of car, A.R.A. circular DV-768, except that Cor-ten steel is substituted for the nearest practical approximate section in strength, and also high-tensile steel wheels weighing approximately 665 lb. each have been used. The weight of the trucks is 13,660 lb., a saving of about 2040 lb. per car. The light weight of the car is

BUILT along the conventional lines of the A. R. A. 1932 design of box car, this car was built with a total weight saving of 7900 lb.

A SAVING of 2040 lb. per car was effected in the trucks.



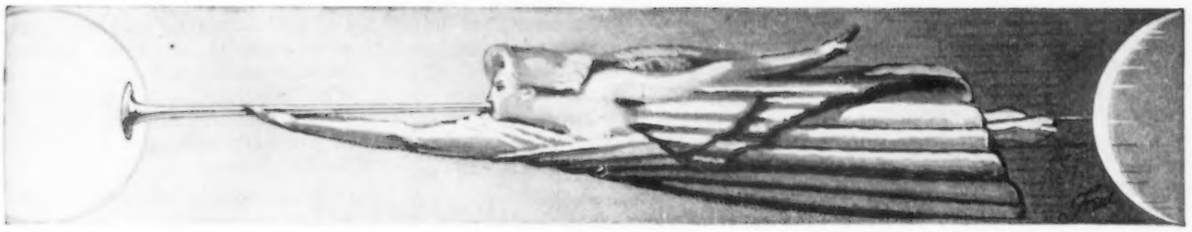


castings have been used in couplers and coupler yokes. A Cor-ten reservoir has been used instead of a cast reservoir on the air brakes. Cor-ten single-strength train pipe has been employed instead of double strength. On the trucks, high-tensile steel side frames and truck bolsters, light-weight brake beams and cast iron light-weight special annealed

36,400 lb. The greater portion of the weight reduction is due to the use of Cor-ten or similar alloy steel. The underframe and superframe were built of Cor-ten plates, sheets, shapes and bars throughout. Cor-ten alloy weighing 9716 lb. replaces 13,395 lb. of plain steel, making a saving of 3679 lb., or 27½ per cent on structurals.

There is a further reduction by the use of Cor-ten or similar alloy steel on the following: Air brakes, Cor-ten steel reservoir, dreadnaught ends, Murphy improved solid steel roof, Cor-ten single-strength train pipe, rivets and bolts, Youngstown corrugated doors and Camel door fixtures. This brings a total saving on account of alloy rolled steel up to 5410 lb.

(CONTINUED ON PAGE 47)



NEWS OF THE WEEK

Employee Elections in Pittsburgh District

VOTING at annual elections of employee representatives at various steel plants last week in the Pittsburgh and Valley districts ran heavier, in most instances, than that in 1934. Final returns from the Carnegie Steel Co. plants, the Jones & Laughlin Steel Corpn.'s plants and the Sharon Steel Hoop Co. are shown in the accompanying table.

Spokesmen for the employee representation groups at the Jones & Laughlin Steel Corpn. plants stated that only 8 votes at Aliquippa Works and three votes at the Pittsburgh mills were cast for non-members of employee groups.

Annual elections of employee representatives at the National Steel Corpn. subsidiary companies' plants will be held next December.

	Eligible Voters	Votes Cast	Percentage
Carnegie Steel Co.			
Homestead District	7,126	5,866	82.4
Edgar Thomson	2,967	2,414	81.5
Duquesne	3,908	3,801	97.25
Clairton	3,368	3,058	90.8
Farrell	1,285	1,219	94.86
Mingo	1,188	1,103	92.8
City Furnaces	306	302	98.69
River Transportation	355	314	88.45
Youngstown District	6,093	5,494	90.2
Total	26,596	23,575	88.64
Jones & Laughlin Steel Corpn.			
Aliquippa Works	8,901	8,735	98.1
Pittsburgh	6,372	6,243	98.0
Total	15,273	14,978	98.plus
Sharon Steel Hoop Co.	1,991	1,976	99.25

Drill Co. to Honor Two Old Employees

THE Cleveland Twist Drill Co. will shortly celebrate the fact that two of its employees combine a total of 110 years of service with the company.

The employees in question are F. F. Prentiss, chairman of the board of directors, and R. D. Boltey, senior Cleveland salesman. Each has served the company for 55 years.

Francis Fleury Prentiss was born August 22, 1858, at Montpelier, Vt. In 1872, he moved to Winona, Minn., with his parents. Not unlike most boys of his day, he received a common school education. In 1879, at the age of 21, he moved to Cleveland and began the manufacture of locks under the firm name of Davies & Prentiss. In 1880 he became a partner of J. D. Cox, Sr., formed the firm of Cox & Prentiss, manufacturing milling machines, planers and twist drills. From a small building, on the flats of Cleveland, employing 12 men, the business grew steadily until, today, it employs more than 500 people. During the growth, Mr. Prentiss served successively as superintendent, manager, vice-president, president and, now, chairman of the board. He is a director of several commercial enterprises, takes a great deal of interest in the factory workers, and is president of Cleveland's Hiram House, a well-known settlement house organization. He is president of St. Luke's Hospital, trustee of Western Reserve University, trustee of Case School of Applied Science, trustee of Cleveland Museum of Art, as well as of the Cleveland School of Art. He is a past president of the Cleveland Chamber of Commerce, and served several terms as chairman of the City Plan Commission.

R. D. Boltey was born in Cleveland, literally in a cemetery. His father was the sexton. At the age of 11 he worked for a week or two in a basket factory. Not satisfied with that, he went to work building boats. Still not satisfied, he joined the small organization of the Cleveland Twist Drill Co. His first job consisted of brushing the flutes on drills; then cutting off steel. From this he went to what was then known as the bit stock department; at the tender age of 15, he was head of this department, commanding the work of five other boys. Soon he progressed from one department to another until he covered every operation in the factory. In 1905, Mr. Boltey joined the sales department, where he has been ever since.

Ingot and Castings Output in 1934 Totaled 26,055,289 Tons

PRODUCTION of steel ingots and castings in 1934 amounted to 26,055,289 gross tons, according to official figures just announced by the American Iron and Steel Institute. The total compares with 23,232,347 tons in the previous year and with 13,681,162 tons in 1932. Of the 1934 total, 25,948,744 tons was ingots and 106,545 tons was castings.

Output of alloy steel ingots and castings amounted to 1,612,275 tons, consisting of 1,595,544 tons of ingots and 16,731 tons of castings. In 1933, 1,547,183 tons of alloy ingots and castings was turned out, ingots having made up 1,475,400 tons of the total.

Rolled iron and steel production in 1934 was 18,969,506 gross tons, compared with 16,735,086 tons in 1933 and with 10,451,088 in 1932.

Detailed figures are shown in the accompanying tables.

TOTAL STEEL PRODUCTION (Includes steel for castings)

Years	Open Hearth			Bessemer	Crucible	Electric	Total
	Basic	Acid	Total				
1920	31,375,723	1,296,172	32,671,895	8,883,087	72,265	505,687	42,132,934
1921	15,082,564	507,238	15,589,802	4,015,938	7,613	170,444	19,783,797
1922	28,387,171	921,812	29,308,983	5,919,298	28,606	346,039	35,602,926
1923	34,665,021	1,234,636	35,899,657	8,484,088	44,079	515,872	44,943,696
1924	30,719,523	857,827	31,577,350	5,899,590	22,473	432,526	37,931,939
1925	37,087,342	947,146	38,034,488	6,723,962	19,562	615,512	45,393,524
1926	39,653,315	1,038,664	40,691,979	6,934,568	15,493	651,723	48,293,763
1927	37,144,268	924,067	38,068,335	6,191,727	9,036	666,087	44,935,185
1928	43,200,483	913,473	44,113,956	6,620,195	7,769	802,260	51,544,180
1929	47,232,419	1,120,469	48,352,888	7,122,509	6,645	951,431	56,433,473
1930	34,268,316	780,856	35,049,172	5,035,459	2,253	612,599	40,699,483
1931	22,130,398	379,168	22,509,566	3,023,446	1,547	410,942	25,945,501
1932	11,742,682	164,648	11,907,330	1,532,076	645	241,111	13,681,162
*1933	20,057,146	324,526	20,381,672	2,428,791	681	421,203	23,232,347
†*1934	23,256,417	274,688	23,531,105	2,162,357	531	361,296	26,055,289

STEEL INGOT PRODUCTION (BY PROCESSES)

Years	Open Hearth			Bessemer	Crucible	Electric	Total
	Basic	Acid	Total				
1920	30,926,393	759,102	31,685,495	8,778,107	70,536	347,254	40,881,392
1921	14,864,607	290,750	15,155,357	3,977,129	6,877	84,721	19,224,084
1922	27,961,190	517,045	28,478,235	5,871,565	27,561	191,057	34,568,418
1923	34,093,711	653,337	34,747,048	8,416,576	42,127	279,914	43,485,665
1924	30,263,005	454,926	30,717,931	5,846,153	21,096	225,977	36,811,157
1925	36,632,060	484,843	37,116,903	6,670,128	17,729	335,978	44,140,738
1926	39,172,688	533,285	39,705,973	6,891,502	13,452	325,278	46,936,205
1927	36,750,387	493,653	37,244,040	6,153,703	7,696	371,278	43,776,717
1928	42,818,557	454,883	43,273,440	6,591,745	6,516	453,692	50,325,393
1929	46,644,206	576,393	47,220,599	7,091,680	5,762	532,392	54,850,433
1930	33,898,518	367,181	34,265,699	5,020,588	1,563	307,418	39,595,268
1931	21,986,933	194,388	22,181,321	3,011,394	831	235,376	25,428,922
1932	11,689,495	104,794	11,794,289	1,528,544	241	141,328	13,464,402
*1933	19,972,805	195,495	20,168,300	2,425,779	399	299,808	22,894,286
*1934	23,235,688	201,073	23,436,761	2,162,357	531	349,095	25,948,744

PRODUCTION OF ALLOY STEEL INGOTS AND CASTINGS

Years	Ingots	Castings	Total	Years	Ingots	Castings	Total
1920	1,591,939	68,353	1,660,292	1928	3,045,225	169,684	3,214,909
1921	769,293	40,255	809,548	1929	3,764,287	192,920	3,957,207
1922	1,614,392	59,104	1,673,496	1930	2,317,183	126,128	2,443,311
1923	2,014,269	92,220	2,106,489	1931	1,366,010	89,903	1,455,913
1924	1,940,461	85,948	2,026,409	1932	757,560	41,044	798,604
1925	2,320,390	112,583	2,432,973	1933	1,475,400	71,783	1,547,183
1926	2,317,313	146,101	2,463,414	*1934	1,595,544	16,731	1,612,275
1927	2,385,904	145,844	2,531,748				

*The figures reported include estimates for one company which reported in previous years but has failed to report for 1933 and 1934.

†The figures for 1934 include only that portion of the steel for castings which was produced in foundries operated by companies producing steel ingots.

PRODUCTION OF ALL KINDS OF FINISHED ROLLED IRON AND STEEL IN 1934* BY PRODUCTS

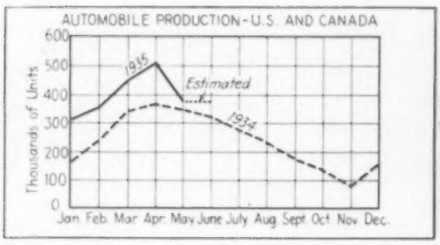
	Steel	Iron	Total
FLAT ROLLED PRODUCTS:			
Plates (sheared and universal)	1,437,704	75	1,437,779
Sheets	3,192,785	9,820	3,202,605
Strip	2,195,793	1,047	2,196,840
Hoops	48,808	.....	48,808
Cotton ties and baling bands	28,300	.....	28,300
Black plate	1,735,431	.....	1,735,431
Total	8,638,821	10,942	8,649,763
BARS:			
Merchant	2,711,074	91,353	2,802,427
Concrete reinforcement	486,950	54	487,004
Total Bars	3,198,024	91,407	3,289,431
Structural shapes	1,425,035	5	1,425,040
Sheet piling	107,843	.....	107,843
Rails	1,010,224	.....	1,010,224
Long splice bars, tie plate bars, etc.	339,306	8,986	348,292
Skelp	1,071,505	48,712	1,120,217
Blanks or pierced billets for seamless tubes	824,542	.....	824,542
Wire rods	1,723,219	546	1,723,765
Car wheels (rolled steel)	76,473	.....	76,473
Cross ties	10,891	.....	10,891
Rolled forg. blooms, billets and axle blanks	211,122	1,217	212,339
Blooms, billets, slabs and sheet bars for export	23,363	.....	23,363
All other fin. hot rolled products	146,998	325	147,323
Total	6,970,521	59,791	7,030,312
Grand total	18,807,366	162,140	18,969,506

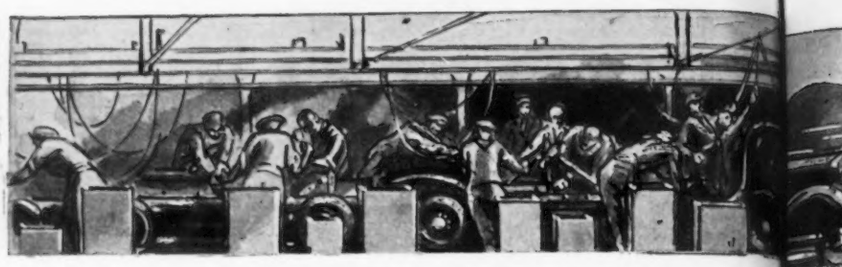
PRODUCTION OF FINISHED ROLLED PRODUCTS, SHOWING IRON AND STEEL PRODUCTS SEPARATELY

Years	Steel	Iron	Total
1920	30,970,297	1,377,566	32,347,863
1921	14,228,329	545,677	14,774,006
1922	25,546,907	905,097	26,452,004
1923	32,321,479	955,597	33,277,076
1924	27,386,959	699,476	28,086,435
1925	32,659,685	727,275	33,386,960
1926	34,819,038	676,854	35,495,892
1927	32,334,687	544,344	32,879,031
1928	37,177,939	484,977	37,662,916
1929	40,594,367	475,049	41,069,416
1930	29,196,954	316,053	29,513,007
1931	18,987,168	188,726	19,175,894
1932	10,352,376	98,712	10,451,088
*1933	16,604,433	130,653	16,735,086
*1934	18,807,366	162,140	18,969,506

PRODUCTION OF ALLOY STEEL INGOTS AND CASTINGS (BY PROCESSES)

Processes	1931	1932	1933	†1934
Open hearth steel—basic	1,131,491	616,719	1,169,255	1,278,343
Open hearth steel—acid	57,864	27,236	57,097	34,540
Bessemer steel	34,044	13,651	24,519	53
Crucible steel	401	121	102	103
Electric steel	232,113	140,877	296,210	299,236
Total	1,455,913	798,604	1,547,183	1,612,275





THIS WEEK ON THE

Automobile Production in Last Half Estimated at 1,160,000 Units

DETROIT, June 25.

WITH the end of the first half of the year at hand, automotive production is continuing to zip along at a much faster rate than a year ago. However, it is expected to lose considerable momentum the coming month. Even so, it should equal, and possibly surpass, the 277,690 units made in July of last year.

Biggest impetus to operations this month and next comes from Chevrolet, which is building around 115,000 cars in June and has the same number scheduled for July. Ford, which may top 100,000 units by a slight margin this month, should drop off to about 75,000 next month. Chrysler, currently turning out 16,000 cars a week, probably won't produce more than 45,000 jobs in July.

The volume of cars in dealers' hands is understood to vary widely with individual manufacturers. Chevrolet, short of cars all year, hasn't yet caught up. Its dealers, incidentally, have relatively few used cars. Ford and Chrysler retailers are believed to have substantial stocks of both new and used cars. Since production is shrinking faster than retail sales, *Automotive Industries* believes that no serious clean-up problem is in sight, estimating current stocks of passenger cars at 300,000 units and of trucks at 64,000.

It is clear that the cream is off the year's motor car production and what is left looks pretty watery. In the first six months of 1935 approximately 2,365,000 units were built. Reports made at the annual meeting of the Automobile Manufacturers' Association in Detroit the past week indicated that assemblies for the entire year would be 3,525,000 units. That means that 1,160,000 cars and trucks will come off assembly lines in the last half, or an average of 193,000 a month. In the latter half of 1934 output amounted to 1,099,206 units and in 1930 to 1,200,913 units.

Plymouth to Build Cars at Evansville

Preparations for 1936 cars have superseded operations on current models as the main topic of interest to the industry. Chrysler, seeking to reduce production costs and put its Plymouth division on a better competitive basis with Ford and Chevrolet, will reopen its plant at Evansville, Ind., as a Plymouth assembly plant. Briggs Mfg. Co., a chief source of bodies for Chrysler, will take over the former body plant there of Graham-Paige. This hookup is much like that of Chevrolet and Fisher Body in various cities.

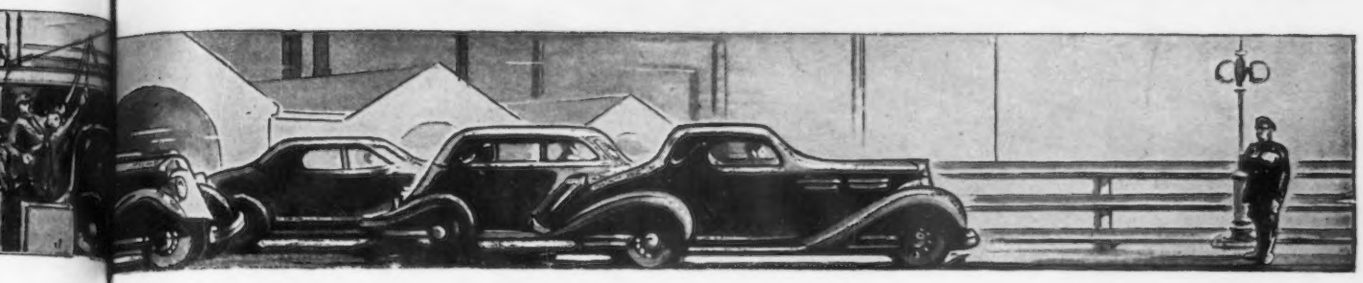
The Evansville plant, which was used as a Dodge truck manufacturing plant, will be ready to operate around Dec. 1 with an initial output of 300 cars a day. This gives Plymouth a third plant, supplementing its capacity at Detroit and at Los Angeles. The most important advantage of branch assembly plants is to be derived from the freight equalizing scheme practised in the automobile industry. A company may have a factory at St. Louis for delivery of cars to customers in that district. On a Chevrolet, for instance, a customer at Granite City, Ill., would pay the list price plus the all-rail freight from Flint, Mich., to that point. The actual delivery cost, however, would be the expense of transporting or driving the car the few miles from St. Louis to Granite City.

The difference between the actual cost and the amount paid by the customer represents a good share of the car manufacturer's profit on the deal. In the case of Chevrolet, it is said that it will be able to pay for its new Baltimore assembly plant (capacity of 80,000 units annually) within a year on the basis of profits from fictitious freight. Plymouth's Evansville plant is strategically located to supply the South and Southwest. Motors and other finished parts will be shipped from Detroit to Evansville. The motor line at the local plant will be strengthened by some purchases of new equipment and will be capable of handling 2400 units a day.

Chevrolet Expands at Saginaw

Concurrent with Plymouth's expansion is a sizable program by Chevrolet for increased operations at Saginaw. It has taken over the old General Motors crankshaft factory there and, it is understood, will build an addition onto it. The bumper plant, now located at Detroit, will be moved to Saginaw, with a possibility that some bumpers the coming year will be made by outside suppliers.

Chevrolet also will make trans-



ASSEMBLY LINE

missions in Saginaw, which will become a major source of supply, along with its Muncie, Ind., plant. The story is going around that the Toledo transmission factory will be completely abandoned, but it appears more likely that operations will be continued there next year on a considerably curtailed scale. This would give Chevrolet three sources of supply on transmissions within its own organization.

It will not surprise anyone should some Buick and Pontiac transmissions also be made at Saginaw, as a part of the diversification program to guard against future tie-ups by strikes. Under consideration at present is the transfer of the manufacture of some small parts, such as valve tappets, from Bay City to the individual plants of Buick, Olds and Pontiac.

Chevrolet is reported to be tooling up all its plants so that it will be ready by Sept. 1 to build 320 units an hour. Chevrolet is resolved that it will not be caught napping in 1936. Its "down" time for retooling will be held to a minimum.

Next year's V-eight Ford will have an all-helical gear transmission giving silent operation at all speeds, according to reliable reports. It will be somewhat similar in design to that used for the last two or three years by Chrysler divisions. Ford also is expected to start equipping part of its cars next year with a cast alloy iron piston which weighs no more than an aluminum piston. This piston is a development of the Campbell, Wyant & Cannon Co. at Muskegon. It will become standard equipment on all cars whenever sufficient production is attained in 1936.

No major body change is anticipated in the new Ford, except the probable shift to an all-steel top. Artillery type steel wheels, with a much larger hub cap than at present, are likely to be adopted.

BY BURNHAM FINNEY

Detroit Editor, The Iron Age

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Buick will be one of the earliest 1936 cars to be announced and will be the initial offering by General Motors. It will not be ready for a public debut, however, until late in September. The new Buick will have turret top, hydraulic brakes, aluminum pistons and the same type of knee action which it now possesses. It will mark the first major change in Buick design since 1934 models were first presented. Those who expect something radical in design will be disappointed. The new Buick will have a snappy appearance, but still will be recognizable as a Buick. Incidentally, Pontiac and Oldsmobile will follow Buick by going over to aluminum pistons.

Packard Operations Large

The new V-12 Lincoln, with turret top, is looked for in August. Although the long-promised Lincoln constitutes a potential threat to its now dominant position in the $1,000 field, Packard is going along so well with its One Twenty that it tentatively has scheduled production of 5000 cars a month for the next five months. It has installed a second assembly line on which convertible coupes are being finished.

Equipment makers, having already enjoyed a square meal of orders at the automotive table this year, are thinking about the feast which will await them in connection with 1937 models. They may be indulging in a bit of wishful thinking, but they are convinced that major mechanical changes in cars cannot be postponed longer than another year. Then there are some plants in the industry which simply won't be able to stay in the production parade unless they look pretty soon to their costs. Machine tool executives, who have been uncannily accurate in their predictions in the past, believe that the flow of business in preparation for 1937 cars will start in the early spring of next year.

To get back to the prospects for the immediate future, they are bright enough to make more than one equipment builder feel like bursting into song. Chevrolet's buying program for Detroit, Flint and Saginaw is of impressive proportions. Pontiac is ticketed to do some machinery buying in the next few weeks. McKinnon Industries, the Canadian General Motors subsidiary which will make transmissions for General Motors of Canada, is understood to have been granted a liberal appropriation for new equipment on which it already has asked for bids. Further purchases are contemplated by Chevrolet for its Muncie, Ind., transmission plant.

Attitude of Steel Buyers

A canvass of sentiment among automotive steel buyers has been made this week on the question of price policies. It indicates that car makers have no intention of making a frontal attack on steel prices. One reason is that buyers today, do not have it in their power to drive prices down to ridiculous levels, there being no great aggregation of stocks at mills, plus the need for speedy liquidation as in 1932. There is opinion, however, that certain prices have gotten out of line and are in need of readjustment and also that some concessions below the regular market price should be accorded to large buyers. Motor car steel buyers point also to the need of readjustments in some extras, particularly those applying to wide sheets.

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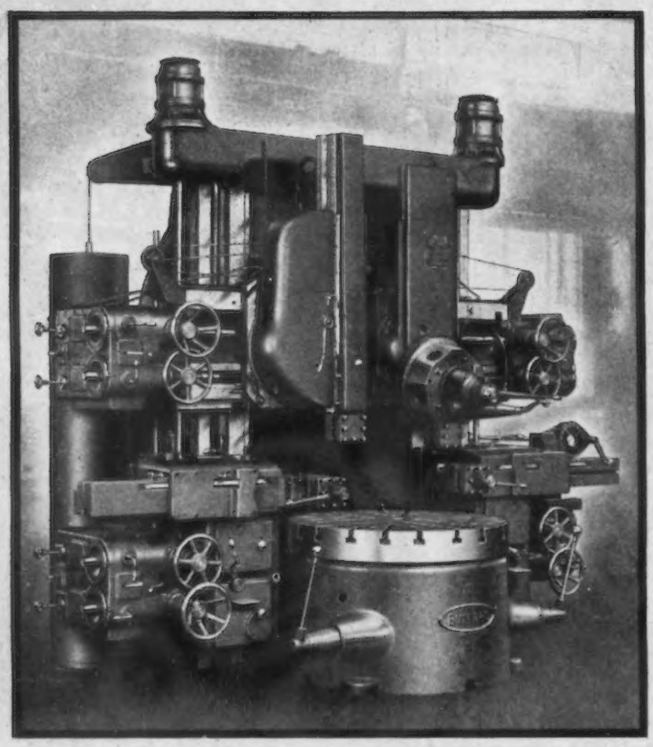

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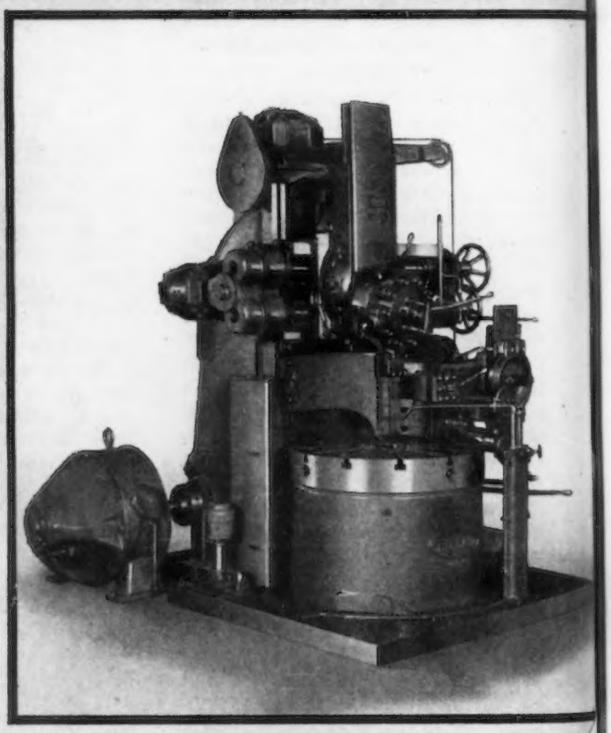

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Machine Tools and the Economic Situation

By HERMAN H. LIND

General Manager, National Machine Tool Builders' Association, Cleveland

MANUFACTURERS who are keeping their machinery modern are producing at costs that will force users of obsolete equipment to modernize, states Mr. Lind. The large percentage of machine tools more than 10 years old and the existence of machines of greatly improved design and performance indicate a large demand ahead. This article is from Mr. Lind's address before the semi-annual meeting of the American Society of Mechanical Engineers, held at Cincinnati, last week.

THE transfer of men from production by human and animal power to production by mechanical power with tremendously enlarged output leads directly to the release of men from the production of the absolute necessities of life for the manufacture of comforts and luxuries which soon are looked upon as necessities. Examples of this are found in the increased tonnage of ocean passenger vessels, the extension of railroads, automobiles and good roads, telephones, household appliances, and various other articles that now are so commonplace. Machine tools and the genius of the men who build them are the fountainhead of this great progress in our economic life.

Nevertheless, there are many vicissitudes in the machine tool industry occasioned by the fact that the machine is so far removed from the individual consumer. When the income of the individual citizen diminishes he can retrench only a little on food, more on clothing, and still more on shelter; but the greatest curtailment of all is in the mechanical products of machinery, and there are many more than enough machine tools to meet the small demand for such products in a period of depression. Therefore, the industry is subject to the widest fluctuations. When Mr. Citizen is in the mood for traveling, for buying automobiles, household appliances, and the like, the purveyors to his fancy bend every effort to provide him with superior products in greater quantities. The demand on the machine tool industry in such a period is terrific. Between the two extremes, however, we find the most erratic irregularities in individual plants and the industry as a whole. The best illustration of this is the fact that in the month of March, 1933, the orders for machine tools amounted to approximately 4 per cent of the orders placed in March, 1929.

In periods of low production the skilled designers, engineers, and mechanics of the machine tool industry are kept at work on improvements in machines that time does not permit when work is being done under high pressure to meet delivery demands. When the demand for the products of machine tools is great the prices of the products are such that economies of new and better machines are not necessary. On the other hand, when business is low those who utilize the machines do not want to spend money. Unfortunately, manufacturers have not yet reached the point generally of putting their depreciation charges aside in cash. Too frequently depreciation and obsolescence reserves have been used in the payment of dividends, which constitute in fact distribution of capital.

Wave of Replacement Ahead

Those manufacturers who are keeping their machinery modern are producing at costs that will force the users of obsolete equipment to modernize. It is estimated that over 75 per cent of the machine tools used in America today are more than 10 years old. The advance in machine tools in the meantime has been such that it is evident there is a large demand ahead.

Generally speaking, the demand for machine tools is actuated by the following motives. First, the natural growth in volume of business necessitates increased output; second, equipment is essential for the production of new goods; third, obsolete machines must be replaced.

The first tendency is illustrated by the slowly rising trend of machine tool production from 1901 to 1917, as illustrated by reports of shipments of 29 companies and again by the industry's Index of Orders as shown on the chart for the years 1921 to 1929. The second motive for increased demand is illustrated by the sharp rise in sales of machine tools in 1906 and 1907 when the manufacture of automobiles began to reach what then seemed important proportions. Replacement of obsolete machines goes on uninterruptedly during all periods of general activity. Such replacement is being made on a small scale at present, and we anticipate a more general wave just ahead.

Large Number of Inefficient Machines in Operation

There is good reason for this expectation. There are a tremendous number of very old and inefficient machine tools now in operation. Manufacturers who use machine tools are notoriously slow to discard the old and install the new. The necessity for low cost production is paramount. Buyers of the products of machinery are extremely price-conscious and they will continue to be so. A relatively small increase in the price of things which users want will freeze sales, and by the same token a lower price will increase sales and enlarge the range of people who will buy. It is in this effort for ever lower costs that the machine tool industry can take just pride in what it has contributed to the higher standard of living in making it possible for the people of this country to enjoy 26 million automobiles, 18 million telephones, an untold number of radios, 6 million mechanical refrigerators, and similar comforts and pleasures.

A rather significant contrast can be noted between the mechanized industries and the unmechanized building industry. Heretofore, the building industry has been given credit quite generally for leading the way out of depressions. This is only natural because in times of adversity a man begins to think of a home for his declining years, and he combines his savings and his credit to acquire this security. However, the building industry has not taken the lead this time, largely due to the relative difference in the cost of houses as compared to

(CONTINUED ON PAGE 65)

THIS WEEK IN WASHINGTON

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BY L. W. MOFFETT
Resident Washington Editor, The Iron Age

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Proposed "Soak the Rich" campaign indicates Administration's definite turn to Left.

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Wagner - Connery bill railroaded through House by Labor's steam roller.

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NRA and FTC to cooperate in administering trade agreements.

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Guffey bill slated for passage despite question of constitutionality.

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Eastman report suggests savings for railroads in sale of scrap.

WASHINGTON, June 25.—Weary and nerve-shocked though it is from a plethora of unpalatable legislative pills, wondering whether it will survive the strange concoctions, the country is being forced to the conclusion that the New Deal doctors have an inexhaustible supply of medicine of experimentation. . . . Disregarding a sensible diagnosis that would show the patient is loudly crying for rest with no more pills, they are being conjured from the medicine case with the mystification of a magician pulling rabbits from his hat. . . . If the patient begins to exhibit signs of recovering from one shock, another shot is injected into his system to produce more tremors. . . . The course being prescribed is necessary to a more recumbent life. . . . Part of the technique is to keep the patient guessing . . . guessing what is coming next . . . a fatal dose or one that only will make his creeping paralysis creep a little creepier and faster. . . . The patient well knows he is in for a surprise . . and would be surprised if he were not surprised.

A groggy, sullen Congress, tired of playing the role of wet nurse, would like to throw out the window, or at least lay aside until next session, the additional dope it is being told to jam down the patient's throat. . . . Though it shows symptoms of rebelling against the doctor's orders, it is shy of spinal structure . . . one reason being the huge $4,800,000,000 political club menacingly held over its dizzy head . . . to say nothing of what might—or might not—happen if it broke over the traces on the eve of a new campaign for reelection. . . . It is almost as anxious as is the country, if that is possible, to close shop and go home, and let the patient try the rest cure.

The latest surprise legislative pill, that is the latest up to this writing, was the share-the-wealth tax message, sprung upon an unsuspecting Congress by the President last Wednesday. . . . Because Messrs. Townsend, Sinclair and Father Coughlin did not come back quickly with sympathetic approval of this political clap from their own thunder, the supposition is it had rendered them speechless. . . . As for Huey Long, his prop knocked from under him, he arose uneasily and mumbled "Amen" as he dusted himself off. . . . Colleagues of Huey said he had been out-hooeyed.

Accustomed as it is to surprises, even Washington lost its breath when it was announced that the President and Congressional leaders at the White House conference Monday night agreed to make an effort to rush the program through congress this week though there is doubt that this can be done.

There were, of course, other distasteful legislative pills, previously prescribed, which were worked or being worked through the system of the patient . . . the Wagner-Connery labor disputes—how appropriate the plural noun—Guffey-Snyder coal, social security and holding company bills . . . and indications are more pills will be prescribed. . . . They're being rolled on a 24-hr. shift without code restraints.

Soaking the rich is a political pill with a sugar coating. . . . There are relatively few who are rich and many who are not. . . .

Imposition of inheritance and gift taxes superimposed upon present estate taxes is not a new suggestion and it may well be believed that, if it does not take the form of confiscation, will find popular appeal. . . . So too the idea of restricting large incomes, particularly those in excess of $1,000,000, by very high taxes, has been advocated with increasing insistence during the depression but, inasmuch as there is a distinct scarcity of such income these days, the resulting revenue would be small. . . . There are 46 such incomes today, it is said. . . . A graduated income tax on net corporate incomes starting at 10¾ per cent for small corporations and increasing to 16¾ per cent for the largest companies—whatever a small corporation and a largest company are—in place of the present flat rate of 13¾ per cent, wouldn't raise much revenue either in these times. . . . Plainly discriminatory, this was the only tax proposal that carried specific rates. . . . It so happens that, despite the political yen to help the little fellow, he is the one who in some important lines is making net returns, while the big fellows are still in the red or on the border line.

The idea back of the whole scheme, in addition to "sharing the wealth," seems to be to take the bigness out of business, of which so much is heard in New Deal circles . . . excepting the bigness in the Federal government, grown to gargantuan proportion . . . and to bust the country into little businesses, many of which are dependents upon big corporations for supplies and services. . . . Back to oxcart days. . . . The big corporation, always a political football, is having a difficult time as it is, and heavier burdens would not only hurt it but the labor it employs, thanks in part to the surpluses, which, it seems, must be whittled down. . . . The upshot might easily be less revenue and greater relief rolls. . . . The Supreme Court once threw out a graduated tax plan which was proposed on chain store gross sales.

The idea of taxing bigness, whether corporation, personal income or inheritance, when allowed to go beyond reason and a sense of equity, has a distinctly socialistic flavor . . . and it can be readily made a tax on skill, knowledge, thrift and enterprise, which if discouraged would leave little to be taxed. . . . Wonder is aroused too as to whether or not the Government wouldn't waste the money, just as it is wasting millions upon millions now, pouring forth from its spending factory.

The program, again with the idea of striking at "bigness in business," proposes elimination of "unnecessary holding companies in all lines of business," whatever that means . . . many think it really means all holding companies . . . and that the contested "death sentence" provisions in the public utility holding company bill may be the entering wedge.

Proceeding pell-mell, the message also suggested a constitutional amendment to permit taxation by the Government of subsequently issued State and local securities and taxation by State and local governments of future issues of Federal securities. . . . The latter suggestion, the President said, was made "by my predecessors" . . . when one even gives a casual study of the proposals, it is not strange that, aside from "Progressives," Congress balked about trying to shove through such a program at the present session. . . . Though the President said, after delivering the message, he would welcome action before adjournment, most members of Congress think reenactment of the nuisance taxes was enough in that line for this session. . . . But the tax program shows plainly what has been so often said, outside political circles, that heavier taxes on both small and large incomes are inevitable in view of tremendously mounting Government costs and laggard industrial recovery. . . . And there is growing fear of dangerous inflation.

Wishful thinking, deserving of sympathetic understanding, had it that the Wagner-Connery labor disputes bill might be defeated in the House. . . . The power of organized labor's steam roller, though known to be great, was underestimated . . . for the bill, previously jammed through the Senate by the smashing vote of 63 to 12, went through the House by a wide margin also. . . . It was not a record vote, but the dominance of the "ayes" easily swamped the "noes". . . . The seven hours' debate in the House was heated at times, but it was only a wordy scrimmage after all. . . . The few who spoke against the bill were quickly subdued. . . . Their well-taken point that the bill is unconstitutional got exactly where all such talk gets, and that is nowhere. . . . Despite the crushing socks the New Deal has received at the hands of Supreme Court, it tears ahead, heedless of "horse and buggy" decisions. . . . Decisions on the Wagner-Connery and Guffey-Snyder coal nationalization legislation are inevitably to come, and warning that tests will be made has been given, but the cases probably will not reach the highest court until the political campaign is over and that is the thing that counts.

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Guffey Bill Slated for Passage

DESPITE protests from captive mine and other interests, including a wide section of the coal industry itself, indications are that the Guffey coal nationalization bill will soon be law. It is one of the measures on the President's "must" program of the current session of Congress. The bill already has passed the Senate. It was the object of hearings last week on the House side and probably will be reported to the House at the end of the present or early next week.

Among witnesses testifying against provisions of the bill was Thomas Moses, president of the H. C. Frick Coke Co. Just as various steel companies had previously done when the bill was on the Senate side, Mr. Moses protested against the inclusion of captive mines in its administration. He pointed out that captive coal mines do not sell to the commercial trade and therefore have nothing to do with the declared purpose of the bill to regulate competitive conditions. It was contended that it was unfair that captive mines, in view of this fact, should be compelled to contribute to the taxes provided for in the bill or accede to its requirement that a nationally established union must be recognized for purposes of collective bargaining.

The bill, in its marketing provisions, calls for a 25 per cent tax, based on the selling price of coal, of which 99 per cent is withdrawn so long as the fixed prices are adhered to. Another provision calls for a tax to create a $300,000,000 fund, with which the Government would take over so-called marginal lands.

The bill is sponsored by the United Mine Workers, who threatened to go on strike June 17 unless it was enacted. When Administration support was thrown back of the bill, the strike was postponed until June 30 pending further wage conferences, now under way. Nevertheless it is confidently believed the union definitely will not go on strike but will await passage of the bill, even if the House is unable to act until after June 30.

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Protests Walsh Bill

John C. Gall, associate counsel, National Association of Manufacturers, testified before the Senate Committee on Education and Labor that the Walsh bill, giving the

President power to fix labor standards in connection with Government contracts, would run squarely afoul of the Supreme Court's decision in the Schechter case.

"It would not represent a congressional determination of minimum wages or maximum hours to be observed in the performance of Government contracts," Mr. Gall said, "but would represent a delegation of blanket authority to the President to determine in every instance what minimum wages and what maximum hours the contractors should be required to observe.

"The measure contains practically the identical defects of the code making provisions of the National Industrial Recovery Act, which were invalidated in the Schechter decision, since there is no standard whatever to guide the President in the determination of wages and hours to be imposed.

"There is no legal distinction between a delegation of authority in the field of Government contract and a delegation generally, as was done in the recovery act."

Mr. Gall also pointed out that since this legislation is general in terms and applies to purchases of or contracts for construction, supplies, material, or service by any agencies of the Government, it supersedes all previous legislation inconsistent with its terms and thus may operate to set aside the Bacon-Davis Prevailing Wage Act, and provisions of the recently enacted Emergency Relief Act dealing with prevailing wages.

Mr. Gall also inserted in the record a discussion of the recent Treasury Department letter proposing that until legislation is passed, all contracts carry a stipulation that the contractor agrees to abide by whatever minimum wages or maximum hours later are established.

"In our opinion," the bulletin sent to members of the association said, "the requirement of such an undertaking from bidders is unwarranted in law and violates the fundamental legal principles underlying the granting of Government contracts."

NRA and FTC to Cooperate in Administering Trade Agreements

WASHINGTON, June 25. — Legislative kinks of a newly drafted NRA bill, to be offered at the present session of Congress, are expected to be ironed out soon as a result of meetings between members of the skeletonized NRA and the Federal Trade Commission. Hitherto at sharp odds with each other, these two Government bodies have patched up their differences and under the plans being studied will share the work of establishing and administering voluntary trade agreements.

Tentatively, it is said NRA would have charge of labor problems under the agreements, while the FTC membership would be increased from four, as at present, to perhaps as many as nine commissioners, and would handle fair trade practices.

Meanwhile it is reported that more voluntary trade agreements are being drawn by industries, mostly small ones, for consideration as soon as a policy of procedure is determined upon. Partially by reason of the uncertainty surrounding the voluntary trade agreement plan, together with the belief that it will yield little or no benefit, but rather would only invite undesired Government intrusion, the response of industry to the new NRA set-up has been mild.

In some industries, also, and this includes steel, it is reported they feel that they can go on with their own agreements more satisfactorily than they can under the limitations now permitted to NRA. Moreover, steel with other industries, is said to be cold to the idea of engaging in any agreement to which the FTC is a party. The steel industry and the commission long have been at loggerheads over the basing point system and the many issues it involves.

Perhaps one outstanding reason for no greater response than has been forthcoming from industry for voluntary agreements is the uncertainty surrounding the anti-trust amendment in the sharply curtailed recovery act. It is said that this amendment likewise is the cause of much of the discussion given at the NRA-FTC meetings, and on its outcome depends the nature of the final draft of legislation, which Congress generally would like to pass up for this session but which the Administration is said to be prepared to ask for before adjournment.

There are also reports that another plan such as the President's Reemployment Agreement may be proposed. Whether true or not, it is said it has been suggested because of communications reaching NRA from industries indicating that maintenance of fixed wages and hours would obviate much of the necessity for fair trade practices. It is recalled that S. Clay Williams, former chairman of NIRB, held to the principle that a standard of fixed wages and hours were in themselves guarantees of fair trade practices and a deterrent to destructive price competition.

Government sanction of agreements is expected to be indicated by distinctive labels, to replace the Blue Eagle. Also the Administration plan for legislation demanding strict adherence to code wages and hours before contractors will be allowed to participate in Government business is said to be in mind as a means of compelling compliance.

In receiving applications for voluntary agreements it is understood NRA is requiring briefs to show that they will not violate the anti-trust laws. The briefs, according to the reported plan, will be studied by NRA, FTC, and the Department of Justice. It is also reported that it is proposed that agreements shall be made as simple and as nearly uniform as possible, thus getting away from the former complicated, conflicting code system. By way of enforcement, it is said study is being given to possible provisions for liquidated damages, reinforced by labels with the implication of a boycott for non-compliance.

However, there is considerable strong dissent from such provisions, both because of their doubtful legal character and by reason of the fact that they would violate the spirit of voluntary agreements. It is considered certain that such provisions as open price filing or even a mild form of price protection cannot be included within the law as it now exists. Whether effort will be made in the pending legislative draft to cover these points is not known. Certain it is if such provisions do reach Congress they will meet lively hostility at the hands of the same groups that attacked the NRA even before it was wrecked by the Supreme Court decision.

Finally, it is clearly evident that NRA has taken on a conservative tone under the leadership of Chairman James L. O'Neill, who is eschewing any sort of ballyhoo. This very fact, in the opinion of many, will give NRA much of the strength that it may gather.

Eastman Outlines Possible Savings to Railroads in Scrap Preparation and Sales

WASHINGTON, June 25.—That substantial savings can be made by the railroads through reducing the cost of the handling and disposition of scrap and the securing of a higher average price for scrap sold is indicated in a report on the subject made public last week by Joseph B. Eastman, Federal coordinator of transportation. The report is based on an extensive survey covering 1933 scrap sales by Class I, II and III railroads and switching and terminal companies made by the transportation coordinator's section of purchases.

In addition to explicit recommendations, the report contains a great deal of tabular statistical data covering sales of scrap by the railroads. Of particular interest is a breakdown of scrap sold by grades which is shown in the accompanying table.

Purposes of Survey

In his letter of Oct. 29, 1934, transmitting Scrap Survey Inquiry S. P. 1 to the railroads, the Federal coordinator of transportation outlined the broad purposes of the study as follows:

". . . to develop information on:

1. The costs of handling and preparing scrap for the market, and the net revenue accruing to the railroad through the sale of scrap;

2. The advantages and disadvantages of dismantling equipment versus sale 'on wheels' or dismantling by outside agencies;

3. The possibilities for economy through the establishment of central scrap plants to serve two or more roads; and

4. The relative position of the railroads as scrap producers."

Three of these questions were definitely answered by the data presented in the report. The average cost figures developed by the study for the railroads as a whole should hold true almost indefinitely, barring major changes in the physical set-up of the industry and changes in labor rates. As regards dismantling, the general indications were that the roads should do it themselves. It was estimated that they would have increased their net return by approximately $1,700,000, if equipment sold on wheels, during 1933, had been dismantled and the resulting scrap sold classified. It was also indicated that the railroads produce approximately 20 per cent of all scrap obtained by the iron and steel industry from outside sources.

Ferrous Scrap Shipped on Sales Orders During 1933, by Classes of Which More Than 10,000 Tons Was Moved, in Descending Order of Tonnage Shipped. Class I Steam Railroads

Class of Scrap[1]	Net Tons Shipped: Number	Net Tons Shipped: Per Cent to Total[2]	Money Received: Dollars	Money Received: Per Cent to Total[2]
TOTAL	2,916,974	100.00	22,804,052	100.00
240 Melting steel, No. 1	599,376	20.55	5,211,138	22.85
290 Rails, steel, No. 3	517,066	17.73	4,481,760	19.65
270 Rails, steel, No. 1	257,488	8.83	2,360,030	10.35
400 Wheels, No. 1	233,395	8.00	1,836,842	8.05
450 Destroyed steel cars and locomotive tenders	182,045	6.24	1,191,934	5.23
350 Structural, wrought iron and steel uncut	153,873	5.27	895,775	3.93
*451 Miscellaneous (described as such)	88,522	3.03	527,374	2.31
230 Malleable	63,242	2.17	485,769	2.13
440 Wrought iron and soft steel, No. 2	53,269	1.83	415,317	1.82
030 Axles, steel, under 5¾ in.	52,087	1.79	481,432	2.11
430 Wrought iron and soft steel, No. 1	47,929	1.64	319,419	1.40
390 Turnings, drillings and borings, No. 2	46,873	1.61	209,725	.92
280 Rails, steel, No. 2	35,761	1.23	271,692	1.19
160 Cast iron brake shoes	35,273	1.21	225,173	.99
420 Wheels, No. 3	35,019	1.20	297,897	1.31
120 Cast iron, No. 1	34,576	1.18	265,367	1.16
020 Axles, steel, 5¾ in. and over	33,044	1.13	289,860	1.27
170 Couplers and knuckles	32,504	1.11	281,021	1.23
060 Angle and splice bars	31,010	1.06	257,425	1.29
300 Sheet scrap, No. 1	29,029	1.00	116,460	.51
340 Steel, spring, coil	26,833	.92	229,190	1.00
140 Cast iron, No. 3	25,842	.89	186,817	.82
090 Bolsters and side frames	24,159	.83	149,881	.66
210 Flues, tubes and pipe	21,301	.73	135,011	.59
110 Cast steel, No. 2	20,536	.70	120,636	.53
*073 Locomotive scrap cut from loading	20,275	.70	133,948	.59
150 Cast iron, No. 4	18,105	.62	102,588	.45
070 Boilers	15,960	.55	68,121	.30
180 Frogs and switches, uncut	13,125	.45	84,757	.37
080 Boilers, fire boxes and tanks, cut-up	13,050	.45	81,814	.36
310 Sheet scrap, No. 2	12,981	.44	44,531	.20
250 Melting steel, No. 2	12,872	.44	98,432	.43
*452 Miscellaneous (variously described)	12,251	.42	71,662	.31
370 Tires, No. 2	11,987	.41	96,123	.42
*453 Shop scrap; misc. car loco., or mixed car and loco.	11,953	.41	72,523	.32

[1] A.A.R. scrap classification, except those marked (*). The first two digits are the A.A.R. numbers. The last digit serves in lieu of A, B, C, etc.

[2] Adjusted to the nearest 0.0 of 1 per cent.

Amount of Scrap Handled

Class I, II and III steam railroads and switching and terminal companies shipped 14,912,108 net tons of classified ferrous and nonferrous scrap on sales orders during the five-year period 1929 to 1933, inclusive, according to the report. The Class I roads alone shipped 97 per cent of the total.

During 1933 Class I roads shipped 3,477,186 net tons of ferrous scrap, which consisted of 2,916,974 net tons of classified scrap and 560,212 net tons of metal in the form of scrap equipment.

Shipments of classified ferrous scrap in 1929 were 51.26 per cent greater than in 1933. Assuming that the ratio of tonnage of scrap equipment to tonnage of classified scrap was the same in 1929 as in 1933, total shipments of ferrous scrap in 1929 were 5,259,591 net tons. From this it is estimated that the railroads supplied 19.42 per cent of all scrap consumed by the iron and steel industry during 1929.

During 1933, Class I roads:

1. Dismantled cars and locomotives, the metal parts of which weighed 1,259,333 net tons at a cost of $1.605 per net ton, or $2,021,312.

2. Handled 1,419,028 net tons of scrap at sorting plants at an average cost of $1.194 per net ton, or $1,694,950.

3. Spent on dismantling, sorting and preparing $3,716,262.

4. Received for classified scrap and scrap equipment $27,377,623.

5. Received over and above costs of handling $23,661,361.

6. Recovered from equipment while being dismantled and from scrap while being sorted, usable material worth at 50 per cent of cost new $8,891,770.

7. Lost through the sale of scrap equipment on wheels (net, after de-

ducting money actually received) $1,398,115.

8. Lost through the sale of scrap equipment under various agreements (net, after deducting money actually received) $344,123.

9. Delivered classified scrap and scrap equipment at an estimated cost of $4,916,131.

Fifty-seven per cent of all classified ferrous and 67 per cent of all classified non-ferrous metal scrap shipped on sales orders during 1933 was prepared at scrap sorting and dismantling plants. The remainder was shipped direct from releasing points and required no preparation.

The roads sold direct to the ultimate consumer approximately 29 per cent of all classified ferrous scrap shipped during 1933.

Recommendations Made

The recommendations made in the report may be described briefly as follows:

1. That the individual roads cooperate with each other for the purpose of making joint study of the data presented in the report, with a view to discovering possible improvements;

2. That scrap be prepared to the highest quality grades;

3. That the roads themselves dismantle their scrap equipment, rather than sell it on wheels;

4. That uniform accounting be set up, and more detailed costs determined;

5. That scrap sorting operations be consolidated with dismantling operations on individual roads;

6. That the possibilities of establishing group marketing agencies be studied; and

7. That the roads study the means by which the dismantling and scrap handling operations of groups of roads can be centralized.

The order in which the recommendations are listed is without regard to their relative importance. Recommendations 1, 4 and 5, intended for the roads individually, would have no point if it were possible immediately to concentrate all scrap handling in a few central plants. However, they have more immediate possibility of being undertaken while the larger objective is being thoroughly studied, and are most desirable because they would tend to produce a sounder background on which to develp that project.

The two recommendations, on group marketing and centralizing scrap handling both depend for their development upon cooperation among the individual roads. In all other respects they are unrelated, and the first need not be delayed awaiting development of the second.

PERSONALS

CHARLES R. ROBINSON, heretofore vice-president in charge of the railroad sales department of the Inland Steel Co., Chicago, has been appointed first vice-president and general manager of sales. Mr. Robinson started his business career in 1890 as a salesman of tool steel for Park Brother & Co. and went into business for himself

C. R. ROBINSON

in 1900. In his first affiliation with the Inland company in 1904, he served as a salesman, becoming assistant general manager of sales in 1906. He resigned in 1908 to become district sales manager at Chicago for the Lackawanna Steel Co., and after a series of promotions was made vice-president in charge of sales. He returned to the Inland company in January, 1922. He is also president of the Inland Tar Co., a subsidiary of the Inland Steel Co.

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V. T. RENNER has been made manager of sales, sheet division, Parkersburg Iron & Steel Co., Parkersburg, W. Va.

❖ ❖ ❖

THOMAS C. SWOPE has been appointed to represent the Kennedy Valve Mfg. Co. in Texas and Louisiana, with headquarters at Beaumont, Tex.

❖ ❖ ❖

CLARENCE E. JACOBSEN, for the past eight years assistant purchasing agent and traffic manager of the Modine Mfg. Co., Racine, Wis., has resigned to become secretary of the Valley Forge Steel & Tool Co., Chicago. He succeeds CLARENCE W. KRUEGER, who has become associated with the Chicago office of Latrobe Tool Mfg. Co. in the capacity of vice-president.

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J. W. BARNETT, recently director of the division of construction and finance, United States Shipping Board, will join the marine department of the Babcock & Wilcox Co. on July 1.

❖ ❖ ❖

M. B. SKIPPER has been placed in charge of sales in the Chicago territory, with office at 407 South Dearborn Street, for the Read Machinery Co., York, Pa.

❖ ❖ ❖

R. T. PALMER has been appointed to handle the sale of Ingersoll cutters in New England and northeastern New York by the Ingersoll Milling Machine Co., Rockford, Ill. He will make his headquarters at 883 Farmington Avenue, West Hartford, Conn. J. A. BOUSLOUGH, with office at 606 North Avenue, Wilkinsburg, Pa., is now covering the eastern Ohio and western Pennsylvania territory for the company.

❖ ❖ ❖

COL. V. A. ROOT, for many years sales manager of the W. F. & John Barnes Co., Rockford, Ill., has been appointed sales manager of the Seneca Falls Machine Co., Seneca Falls, N. Y., and will have charge of sales and advertising. JOSEPH H. FLATHER, who was formerly president of the Flather Co., has been made chief engineer of the company. GEORGE E. FOGARTY, European sales manager, who has been spending several months in the United States, is returning to his headquarters in Paris.

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DONALD A. CROSSET, heretofore engineering director and secretary of the Alloy Metal Wire Co., Inc., Moore, Pa., has been appointed general manager and secretary-treasurer of the company.

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O. E. ROMIG has been appointed manager of the electrical sheet division, American Sheet & Tin Plate Co., with headquarters in the Frick Building, Pittsburgh. He was graduated from Pacific University, Forest Grove, Ore., in 1920; from Oregon State College in 1922, and received his A. M. degree from Harvard in 1924. He was associated with the Research Laboratory, Pittsburgh, and the Vandergrift works of the American Sheet & Tin Plate Co. for five years. For the past five years, he

was metallurgist at the company's Gary, Ind., sheet mill.

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DON D. SMITH has been appointed director of sales of the plumbing ware division of the Briggs Mfg. Co., Detroit. He previously had been vice-president and general sales manager of the Richmond Radiator Co., New York.

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HOWARD E. ROBINSON, who has been vice-president in charge of sales of the Newton Steel Co., Monroe, Mich., has resigned to become general manager of sales for the Otis Steel Co., Cleveland. He succeeds PAUL B. ALLEN, who recently was named as general manager of sales for the Otis company, but who has been appointed vice-president in charge of sales as successor to J. G. CARRUTHERS, who has resigned.

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Dr. Irving Langmuir Honored

THE Holley Medal for 1934 was awarded on June 20, at the semi-annual meeting of the American Society of Mechanical Engineers at Cincinnati, to Dr. Irving Langmuir, associate director of the General Electric Research Laboratory, for his contributions to science and engineering, especially in the development of the gas-filled incandescent lamp, of the thoriated filament for thermionic emission, of atomic-hydrogen welding, of phase-control operation of the Thyratron tube, and in fundamental research in oil films.

DR. I. LANGMUIR

Dr. Langmuir presented a paper at the A.S.M.E. meeting on "The Mechanical Properties of Matter," in which he discussed the opportunities for men trained in physics to make vital contributions to industrial progress.

Chairman Verity turning the first spade full

Armco To Begin Work on Cold Mill

WORK will begin immediately on the construction of a wide cold reducing mill to be located at the East works of the American Rolling Mill Co., Middletown, Ohio. The new mill will be able to produce cold reduced sheets up to approximately 72 in. wide and is being built in response to the needs of the automotive industry for wider sheets.

The cost of the new mill and the necessary revamping of existing plant facilities is estimated at $3,500,000. This is one of the principal items included in the new financing program recently approved by the stockholders of the company. The construction work will not interfere with regular operations at East works.

F. H. McGraw & Co., New York, have been awarded the contract for buildings and foundations. A working force of approximately 150 men will be required to operate the new mill when it has been completed, while some 150 to 200 men will be employed on the construction work. However, company officials point out that it will not be necessary to add any new employees to the payrolls as men already on the company payroll will be given preference.

Bids will be taken to 2 p. m., July 12, by the Bureau of Reclamation, Denver, Colo., for furnishing and delivering f.o.b. cars shipping point or f.o.b. cars Homedale, Idaho, cast iron and radial gates, gate hoists, miter and two-way bevel gear sets, shaftings, railings, and miscellaneous metal work for South Canal, Station 0 to Station 736, Succor Creek Division, Owyhee project, Oregon-Idaho, under Specification No. 696-D. Materials to be installed by Government. Specifications obtainable from above.

Bids will be received up to 2 p. m., July 22, by the Bureau of Reclamation, Denver, Colo., for furnishing and delivering f.o.b. cars at shipping point of bidder or f.o.b. cars Boulder City, Nev., two 168-in. diameter butterfly valves and two butterfly valve bulkheads for installation in the Boulder power plant, Boulder Canyon project, Arizona-California-Nevada, under Specification No. 629. Valves and bulkheads will be installed by the Government. Specifications No. 629 may be obtained from above.

St. Louis Public Service Co., St. Louis, has been authorized to purchase maintenance equipment to cost $15,360, including 20-in. motor-driven piston lathe for machine shop, piston grinder for automotive shop, Lempco No. 303 hydraulic press, with motor and necessary attachments, Essen coil spring tester, Englehart fuel analyzer, No. 1 Racine high-speed metal cutting saw, No. 16 Whitney punch, connecting rod rebabbitting machine, one electric and three air hand drills.

Iron Age Index Again Advances

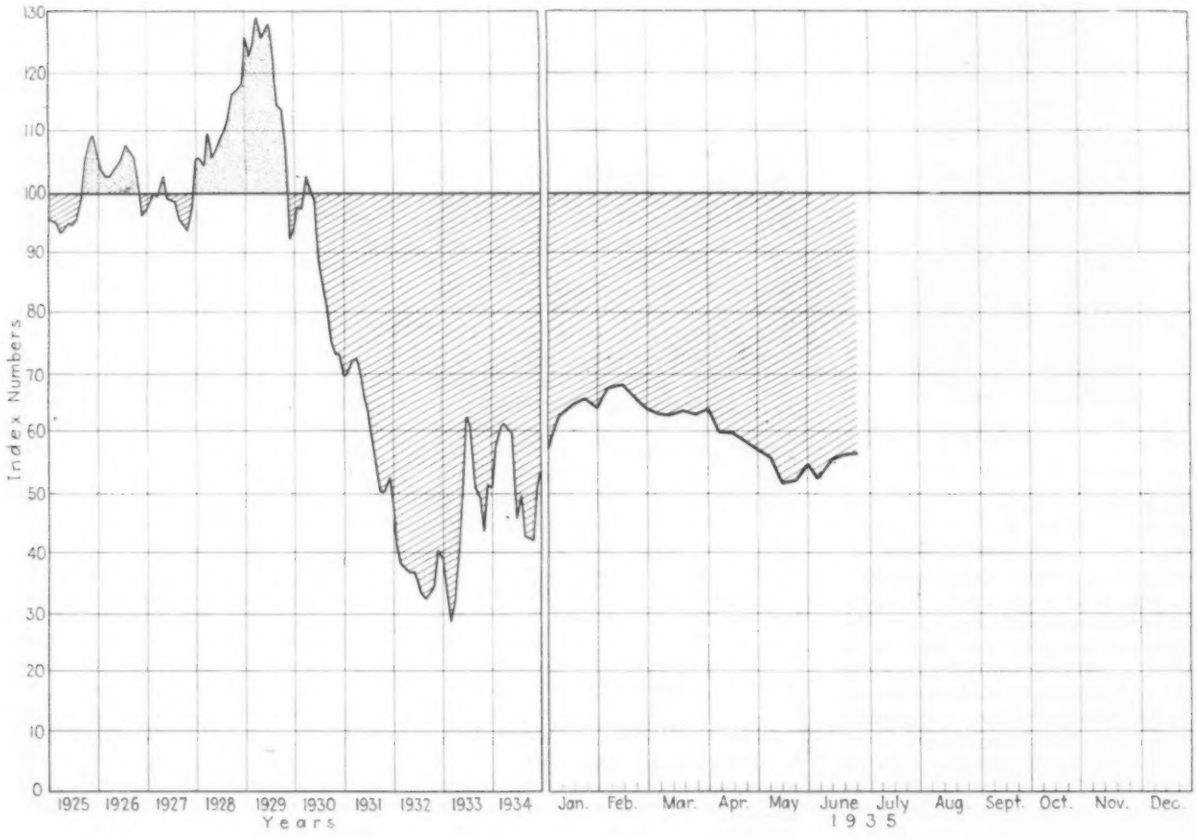
LAST week witnessed a further light gain in capital goods activity as measured by THE IRON AGE index. The estimated index number for last week was 56.5, based on an average of 100 for the period from 1925 to 1927, as compared with a revised figure of 56.2 for the week preceding. At the current level the index shows a recovery of more than 9 per cent from the low point of the year, which was established early in May after a decline amounting to nearly 24 per cent from the peak of 68 in the second week of February.

The Iron Age Weekly Index Numbers of Capital Goods Activity

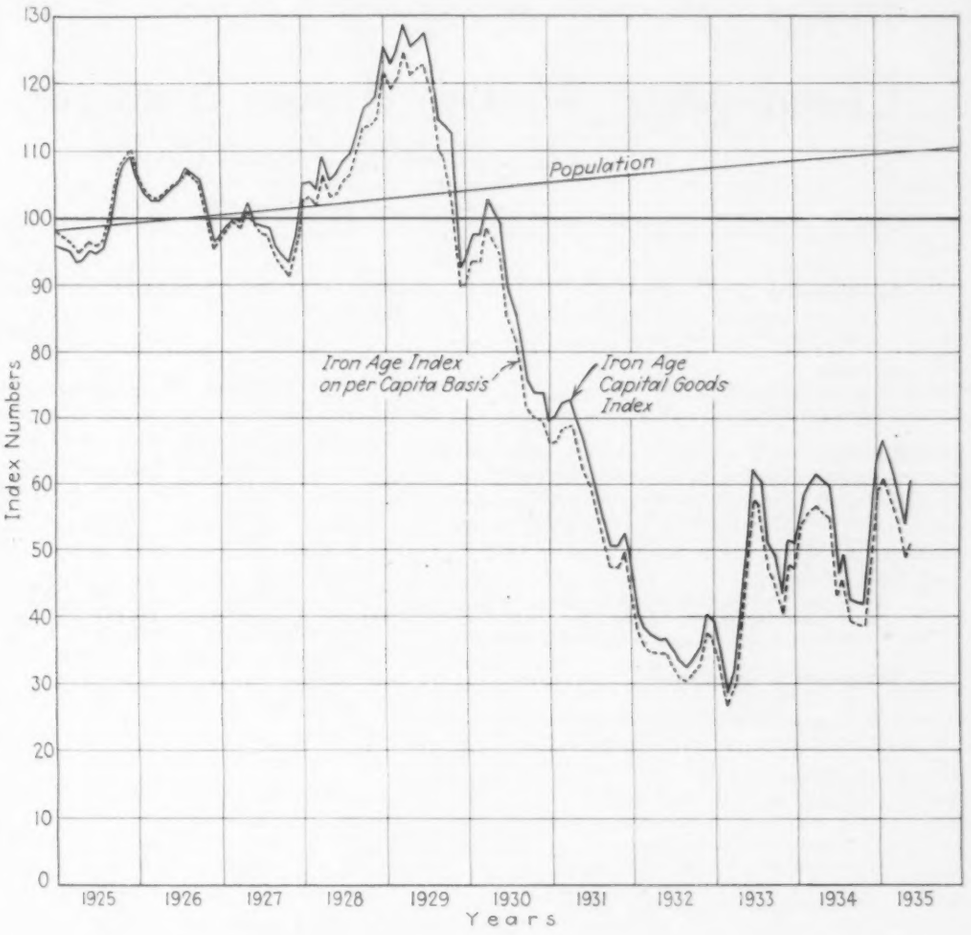
(1925-27 Average = 100)

Last week (est.)	56.5
Preceding week (rev.)	56.2
Same week last month	54.5
Same week 1934	60.8
Same week 1933	54.9
Same week 1932	36.9
Same week 1931	64.4
Same week 1930	97.5
Same week 1929	129.0

Recent gains in the index during the past month and a half have been made in spite of a decline in steel mill activity, which has somewhat exceeded the normal seasonal slackening. Automobile production has been well maintained at high levels, while heavier shipments of lumber and sharp increases in heavy contract awards, reflecting improvement in the con-



The Iron Age Index of Capital Goods Activity. The years 1925 to 1934 are plotted by months, the current year by weeks.



CAPITAL Goods Activity Compared with Population Growth. The dotted line shows The Iron Age index calculated on a per capita basis.

struction industry, have contributed to the current recovery in THE IRON AGE index.

At present levels, the capital goods industries are operating at about twice the rate of activity prevailing at the bottom of the depression in March, 1933. In spite of this gain, however, they have recovered little more than one-fourth of the ground lost from 1929 to 1933.

One homely fact frequently overlooked in the discouragement of the past five years is that, in spite of declines in everything from pig iron production to motion picture admissions, the population of the country has continued to increase during the depression. The chart at the bottom of the page shows IRON AGE estimates of population growth during the past decade compared with THE IRON AGE index of capital goods activity. Both series are plotted monthly on a 1925-27 base, i.e., estimates of actual population have been expressed as percentages of the average population during the three-year base period. The dotted curve shows THE IRON AGE index computed on a per capita basis by dividing each monthly figure by the population index number for the corresponding month.

As a result of this steady growth of the population, which has shown an average gain of approximately 1,300,000 per year during the past decade, the production of capital goods on a per capita basis has fallen to lower relative levels than THE IRON AGE index. This indicates that if the capital goods industries are to supply the needs of the present population no more adequately than during the three years from 1925 to 1927, these industries would have to operate at nearly 10 per cent above the rate prevailing in the base period and at about twice the present rate of activity. In addition there is now an accumulated shortage which is equivalent to more than two years' operations at the rate prevailing during the base period.

Light Weight Car of High-Tensile Steels

[CONTINUED FROM PAGE 33]

A saving of 1064 lb. was made by the use of high-tensile cast steel on the body center plates, couplers, coupler yokes, truck bolsters and truck side frames.

A further reduction of 1426 lb. was effected through special material or design on the following items: 33 in. light-weight cast iron annealed wheels of 665 lb. each, light-weight Creco brake beams, coupler centering device, journal bearings, and elimination of the spring plank, making a total saving in weight of 7900 lb.

In producing this car all existing A.R.A. detailed standards were observed throughout and all general dimensions of the car were held without change. The various sections were scaled down in thickness and sizes to the approximate equivalent strength to the original details of the car. In some cases it was necessary to substitute pressed shapes for rolled sections.

The Federal Coordinator's survey of cars for pooling, made by Mr. Castle in his exhibit 5, shows all the steel box cars built by car builders from 1920 to 1934 inclusive averaged 46,500 lb. This car is 10,100 lb. lighter than the average steel-sheathed car of this type in existence at this time. It is 7900 lb. lighter than the A.R.A. 1932 design of steel-sheathed car.

This car is being exhibited at the Dearborn Street Station, Chicago, June 26 and 27, during the A.R.A. Mechanical Section convention.

Current Metal Working Activity Statistically Shown

These Data Are Assembled By THE IRON AGE From Recognized Sources And Are Changed Regularly As More Recent Figures Are Made Available. Boldface Type Indicates Changes This Week

	May, 1935	April, 1935	May, 1934	Five Months, 1934	Five Months, 1935
Raw Materials:					
Lake ore consumption (gross tons)[a]	2,466,585	2,360,002	2,957,934	11,001,670	12,142,756
Coke production (net tons)[b]	.....	2,736,723	3,255,069	14,538,372	.....
Pig Iron:					
Pig iron output—monthly (gross tons)[c]	1,727,095	1,663,475	2,042,896	7,868,180	8,246,486
Pig iron output—daily (gross tons)[c]	55,713	55,449	65,900	52,107	54,612
Castings:					
Malleable castings—production (net tons)[d]	.....	42,035	37,165	185,701	.....
Malleable castings—orders (net tons)[d]	.....	37,394	32,639	183,148	.....
Steel castings—production (net tons)[d]	.....	31,952	57,313	199,216	.....
Steel castings—orders (net tons)[d]	.....	28,233	46,831	232,013	.....
Steel Ingots:					
Steel ingot production—monthly (gross tons)[e]	2,602,054	2,606,311	3,352,788	13,166,381	13,615,360
Steel ingot production—daily (gross tons)[e]	96,372	100,243	124,177	101,280	104,734
Steel ingot production—per cent of capacity[e]	43.53	45.28	56.40	45.99	47.40
Employment in Steel Industry:					
Total employees[e]	.....	424,623	449,362	419,207	.....
Total payrolls (thousands of dollars)[e]	.....	45,890	51,896	208,934	.....
Average hours worked per week[e]	.....	34.2	37.1	33.7	.....
Finished Steel:					
Trackwork shipments (net tons)[e]	4,228	4,472	5,764	22,463	17,365
Sheet steel sales (net tons)[f]	**149,725**	168,093	246,315	1,070,789	1,016,028
Sheet steel production (net tons)[f]	**191,507**	209,219	256,537	1,049,793	1,082,584
Fabricated shape orders (net tons)[g]	.....	91,228	78,608	200,160	.....
Fabricated shape shipments (net tons)[g]	.....	81,271	104,976	358,030	.....
Fabricated plate orders (net tons)[d]	.....	13,244	21,891	111,438	.....
Reinforcing bar awards (net tons)[e]	12,080	30,490	12,035	89,570	97,770
U. S. Steel Corpn. shipments (tons)[h]	598,915	591,728	745,063	2,693,558	2,975,891
Ohio River steel shipments (net tons)[i]	**78,106**	57,825	73,361	252,714	328,028
Fabricated Products:					
Automobile production, U. S. and Canada[k]	**385,486**	501,837	350,616	1,475,965	1,996,399
Construction contracts, 37 Eastern States[l]	$126,718,600	$124,020,000	$134,363,700	$727,046,500	$548,681,100
Steel barrel shipments (number)[d]	**554,102**	610,848	489,186	3,129,765	2,531,234
Steel furniture shipments (dollars)[d]	.....	$1,122,987	$1,010,528	$4,791,172	.....
Steel boiler orders (sq. ft.)[d]	.....	312,542	277,086	1,556,291	.....
Locomotive orders (number)[m]	2	2	17	80	13
Freight car orders (number)[m]	2	600	517	22,166	1,432
Machine tool index[n]	**73.3**	65.6	45.9	†46.8	†67.1
Foundry equipment index[o]	**100.7**	113.2	66.5	†69.9	†94.4
Foreign Trade:					
Total iron and steel imports (gross tons)[p]	.....	28,886	29,465	142,780	.....
Imports of pig iron (gross tons)[p]	.....	8,247	8,628	60,218	.....
Imports of all rolled steel (gross tons)[p]	.....	13,566	10,063	44,162	.....
Total iron and steel exports (gross tons)[p]	.....	205,336	241,753	1,033,768	.....
Exports of all rolled steel (gross tons)[p]	.....	64,625	105,771	420,213	.....
Exports of finished steel (gross tons)[p]	.....	54,034	69,354	365,533	.....
Exports of scrap (gross tons)[p]	.....	131,731	132,725	595,733	.....
British Production:					
British pig iron production (gross tons)[r]	558,900	526,300	527,900	2,383,500	2,642,700
British steel ingot production (gross tons)[r]	853,300	808,700	780,000	3,749,800	4,031,200
Non-Ferrous Metals:					
Lead production (net tons)[s]	**37,358**	32,389	39,945	180,479	159,114
Lead shipments (net tons)[s]	**32,341**	40,922	29,485	150,168	168,441
Zinc production (net tons)[t]	34,597	35,334	30,944	158,848	175,310
Zinc shipments (net tons)[t]	35,652	38,460	35,589	159,679	185,690
Deliveries of tin (gross tons)[v]	3,950	5,825	4,110	18,600	23,775

*Preliminary. †Three Months' Average.

Sources of figures: [a] Lake Superior Iron Ore Association; [b] Bureau of Mines; [c] THE IRON AGE; [d] Bureau of the Census; [e] American Iron and Steel Institute; [f] National Association of Flat-Rolled Steel Manufacturers; [g] American Institute of Steel Construction; [h] United States Steel Corpn.; [i] United States Engineer, Pittsburgh; [k] When preliminary, from Automobile Manufacturers Association—Final figures from Bureau of the Census; [l] F. W. Dodge Corpn.; [m] *Railway Age;* [n] National Machine Tool Builders Association; [o] Foundry Equipment Manufacturers Association; [p] Department of Commerce; [r] British Iron and Steel Federation; [s] American Bureau of Metal Statistics; [t] American Zinc Institute, Inc.; [v] New York Commodities Exchange.

Steel Production Holds at 38 Per Cent And Scrap Prices Remain Unchanged

Waiting Attitude of Buyers Fails to Drive Output Any Lower—Large Railroad Order and Heavier Construction Awards Are Timely

STEEL production is holding at 38 per cent of capacity, unaltered from a week ago, and scrap prices, as measured by THE IRON AGE composite for heavy melting steel, are unchanged at $10.71 a ton for the third consecutive week.

Seasonal forces are at work, but demand for iron and steel is manifesting staying powers which suggest that minimum levels for the summer are being approached. Caution continues to cause many buyers to allow their stocks to dwindle rather than purchase their current requirements, and it is possible, therefore, that the current rate of production is not fully abreast of consumption. But doubts as to the stability of prices are diminishing with every day that is added to the post-code period, and in certain centers, especially in the Chicago district, mill bookings have taken a contraseasonal turn, moving upward at a time when a further decline was expected.

THE automotive industry continues to be the principal threat to price maintenance. Though motor car makers are careful to make it clear that they have no desire to precipitate a wide-open break in the market structure, they argue that their position as large tonnage buyers of flat-rolled products entitles them to adjustments of both prices and extras, which they contend can be made in an orderly way without disastrous consequences. Initial steel orders for 1936 models will be placed by automotive interests within the next fortnight, but heavy buying is not looked for before August.

Tests of mill prices to date have failed to disclose convincing evidence of weakness. An Eastern maker of automobile frames has contracted for 40,000 tons of hot-rolled sheets at the present price for the third quarter, with the proviso that deliveries during the fourth quarter will be at the market prevailing at that time. The opening of bids on 990 tons of plates for the Navy Department at Washington revealed several variations in delivered prices, ranging from $4 to $8 a ton, but these discrepancies are attributed to errors. The State of New York, failing to obtain lower than prevailing prices on bids for 700 tons of steel for license tags, has asked that new tenders be submitted on a strip basis instead of a pound basis.

WITH the flow of steel to the motor car industry diminishing, mills will soon benefit from some offsetting tonnage as the result of the purchase of 5125 freight cars by the Chesapeake & Ohio. Close to 65,000 tons of steel will be needed, and some of the first releases are expected to reach producers in the second week of July. The Wabash has bought 5000 tons of rails for July and August delivery, and the Norfolk & Southern will soon require material for 500 box cars which it will build in its own shops.

The mills will also get a lift from construction orders. Though considerable uncertainty prevails as to proposed grade separation projects because of restrictions imposed on expenditures of materials for work relief projects, there has been an encouraging increase in the number of pending public projects that are reaching the contracting stage.

Structural steel awards of the week, at 27,000 tons, are the third largest for the year. New projects of 56,675 tons are the heaviest since the third week in February, and include 20,000 tons for an addition to the Department of Interior Building, Washington, 15,000 tons for five locks and four dams in the Mississippi River, and 6500 tons for transmission lines for the Los Angeles water district. Sheet piling inquiries total 25,000 tons, including 14,000 tons for Mississippi River locks and dams, 6000 tons for the second section of a levee wall at Monroe, La., and 5000 tons for a TVA dam in Tennessee.

The general contract for 6500 tons of 26-in. steel pipe for the Fort Smith, Ark., waterworks has been let to Williams Brothers, Tulsa, Okla., and the purchase of the steel is expected to follow shortly.

Total reported awards since Jan. 1 of construction steel, including structural steel, plate work, steel piling and reinforcing are 541,969 tons, as compared with 632,942 tons in the corresponding period in 1934.

TIN PLATE stocks at mill warehouses are beginning to move more freely, but mill operations have receded slightly to 65 per cent. Sheet production is holding at about 50 per cent, while hot-strip output is unchanged at 30 per cent. Wire mill operations average 45 per cent, as compared with 60 per cent in May.

Ingot output is off two points to 32 per cent at Pittsburgh and one point to 30 per cent in the Philadelphia district. The Chicago rate is up 1½ points to 41 per cent, while in the Valleys, where some steel is being made in anticipation of the Independence Day shutdown, operations are up one point to 43 per cent. Elsewhere production is substantially unchanged, with conspicuously high rates of 95 and 48 per cent being maintained in the Detroit and Wheeling districts.

THE IRON AGE composite prices for pig iron and finished steel are unchanged at $17.84 a ton and 2.124c. a lb. respectively. A Chicago district mill has announced Gary base prices on enameling sheets which are 10c. a 100 lb. higher than current Pittsburgh base quotations for the same product. The mill's action followed its entry into the enameling sheet field.

A Comparison of Prices

Market Prices at Date, and One Week, One Month, and One Year Previous; Advances Over Past Week in Heavy Type, Declines in Italics

Pig Iron

Per Gross Ton:	June 25, 1935	June 18, 1935	May 28, 1935	June 26, 1934
No. 2 fdy., Philadelphia	$20.3132	$20.3132	$20.3132	$20.26
No. 2, Valley furnace	18.50	18.50	18.50	18.50
No. 2 Southern, Cin'ti	19.2007	19.2007	19.13	19.13
No. 2, Birmingham†	14.50	14.50	14.50	14.50
No. 2 foundry, Chicago*	18.50	18.50	18.50	18.50
Basic, del'd eastern Pa.	19.8132	19.8132	19.8132	19.76
Basic, Valley furnace	18.00	18.00	18.00	18.00
Malleable, Chicago*	18.50	18.50	18.50	18.50
Malleable, Valley	18.50	18.50	18.50	18.50
L. S. charcoal, Chicago	24.2528	24.2528	24.2528	24.04
Ferromanganese, seab'd carlots	85.00	85.00	85.00	85.00

†This quotation is for delivery in South; in the North prices are 38c. a ton under delivered quotations from nearest Northern furnace.

*The switching charge for delivery to foundries in the Chicago district is 60c. per ton.

Rails, Billets, etc.

Per Gross Ton:				
Rails, heavy, at mill	$36.37½	$36.37½	$36.37½	$36.37½
Light rails, Pittsburgh	35.00	35.00	35.00	35.00
Rerolling billets, Pittsburgh	27.00	27.00	27.00	29.00
Sheet bars, Pittsburgh	28.00	28.00	28.00	30.00
Slabs, Pittsburgh	27.00	27.00	27.00	29.00
Forging billets, Pittsburgh	32.00	32.00	32.00	34.00
Wire rods, Pittsburgh	38.00	38.00	38.00	38.00
	Cents	Cents	Cents	Cents
Skelp, grvd. steel, P'gh, lb.	1.70	1.70	1.70	1.70

Finished Steel

Per Lb.:	Cents	Cents	Cents	Cents
Bars, Pittsburgh	1.80	1.80	1.80	1.90
Bars, Chicago	1.85	1.85	1.85	1.95
Bars, Cleveland	1.85	1.85	1.85	1.95
Bars, New York	2.15	2.15	2.15	2.23
Plates, Pittsburgh	1.80	1.80	1.80	1.85
Plates, Chicago	1.85	1.85	1.85	1.90
Plates, New York	2.09	2.09	2.09	2.13
Structural shapes, P'gh	1.80	1.80	1.80	1.85
Structural shapes, Chicago	1.85	1.85	1.85	1.90
Structural shapes, New York	2.06¼	2.06¼	2.06¼	2.10½
Cold-finished bars, Pittsburgh	1.95	1.95	1.95	2.10
Hot-rolled strips, Pittsburgh	1.85	1.85	1.85	2.00
Cold-rolled strips, Pittsburgh	2.60	2.60	2.60	2.80

Finished Steel

Per Lb.:	June 25, 1935 Cents	June 18, 1935 Cents	May 28, 1935 Cents	June 26, 1934 Cents
Hot-rolled annealed sheets, No. 24, Pittsburgh	2.40	2.40	2.40	2.65
Hot-rolled annealed sheets, No. 24, Gary	2.50	2.50	2.50	2.75
Sheets, galv., No. 24, P'gh	3.10	3.10	3.10	3.25
Sheets, galv., No. 24, Gary	3.20	3.20	3.20	3.35
Hot-rolled sheets, No. 10, P'gh	1.85	1.85	1.85	2.00
Hot-rolled sheets, No. 10, Gary	1.95	1.95	1.95	2.10
Wire nails, Pittsburgh	2.60	2.60	2.60	2.60
Wire nails, Chicago dist. mill	2.65	2.65	2.65	2.65
Plain wire, Pittsburgh	2.30	2.30	2.30	2.30
Plain wire, Chicago dist. mill	2.35	2.35	2.35	2.35
Barbed wire, galv., Pittsburgh	3.00	3.00	3.00	3.00
Barbed wire, galv., Chicago dist. mill	3.05	3.05	3.05	3.05
Tin plate, 100 lb. box, P'gh.	$5.25	$5.25	$5.25	$5.25

Scrap

Per Gross Ton:				
Heavy melting steel, P'gh	$11.75	$11.75	$11.75	$11.75
Heavy melting steel, Phila	10.50	10.50	10.50	10.50
Heavy melting steel, Ch'go	9.87½	9.87½	10.25	9.75
Carwheels, Chicago	10.50	10.50	10.50	9.75
Carwheels, Philadelphia	11.25	11.25	11.25	12.50
No. 1 cast, Pittsburgh	13.25	13.25	13.25	12.25
No. 1 cast, Philadelphia	11.25	11.25	11.25	12.25
No. 1 cast, Ch'go (net ton)	9.00	9.00	9.00	7.50
No. 1 RR. wrot., Phila	10.25	10.25	10.25	12.25
No. 1 RR. wrot., Ch'go (net)	7.75	7.75	8.00	7.50

Coke, Connellsville

Per Net Ton at Oven:				
Furnace coke, prompt	$3.50	$3.50	$3.85	$3.85
Foundry coke, prompt	4.00	4.00	4.60	4.60

Metals

Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Electrolytic copper, refinery	8.75	8.75	8.75	8.75
Lake copper, New York	9.12½	9.12½	9.12½	9.12½
Tin (Straits), New York	**51.25**	51.00	51.75	50.87½
Zinc, East St. Louis	4.30	4.30	4.30	4.20
Zinc, New York	4.67½	4.67½	4.67½	4.55
Lead, St. Louis	3.85	3.85	4.20	3.85
Lead, New York	4.00	4.00	4.35	4.00
Antimony (Asiatic), N. Y.	12.75	12.75	12.75	7.80

On export business there are frequent variations from the above prices. Also, in domestic business, there is at times a range of prices on various products, as shown in our detailed price tables.

The Iron Age Composite Prices

	Finished Steel	Pig Iron	Steel Scrap
June 25, 1935	2.124c. a Lb.	$17.84 a Gross Ton	$10.71 a Gross Ton
One week ago	2.124c.	17.84	10.71
One month ago	2.124c.	17.83	10.83
One year ago	2.199c.	17.90	10.67
	Based on steel bars, beams, tank plates, wire, rails, black pipe, sheets and hot-rolled strips. These products make 85 per cent of the United States output.	Based on average of basic iron at Valley furnace and foundry irons at Chicago, Philadelphia, Buffalo, Valley and Birmingham.	Based on No. 1 heavy melting steel quotations at Pittsburgh, Philadelphia and Chicago.

	Finished Steel High	Finished Steel Low	Pig Iron High	Pig Iron Low	Steel Scrap High	Steel Scrap Low
1935	2.124c., Jan. 3	2.124c., Jan. 8	$17.90, Jan. 8	$17.83, May 14	$12.33, Jan. 8	$10.33, April 23
1934	2.199c., April 24	2.008c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	2.015c., Oct. 3	1.867c., April 18	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.977c., Oct. 4	1.926c., Feb. 2	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931	2.037c., Jan. 13	1.945c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.273c., Jan. 7	2.018c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.317c., April 2	2.273c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3
1928	2.286c., Dec. 11	2.217c., July 17	18.59, Nov. 27	17.04, July 24	16.50, Dec. 31	13.08, July 2
1927	2.402c., Jan. 4	2.212c., Nov. 1	19.71, Jan. 4	17.54, Nov. 1	15.25, Jan. 11	13.08, Nov. 22

Recession in Demand Is Moderate at Pittsburgh

Local Rate Is Off Two Points to 32 Per Cent, Valley Operations Rise One Point to 43 Per Cent, Wheeling District Holds at 48

PITTSBURGH, June 25. — Finished demand in the final week of the first half, while reflecting further contraction, is steady. Automotive releases on a whole are noticeably lighter, but spot orders from miscellaneous consuming groups and from farm implement and machinery makers are in sufficient volume to moderate the seasonal trend in demand.

Steel ingot output in the Tri-State area this week is pursuing a fairly steady course. Production in the Pittsburgh district is off two points to 32 per cent, while activity in the Wheeling district is unchanged at 48 per cent. In the Valleys and nearby northern Ohio mills raw steel output has increased one point to 43 per cent, with some units stepping up production this week in anticipation of complete suspensions during the first week in July.

The rail and accessory market in the Pittsburgh district is extremely quiet, while structural mills this week are enjoying increased business. In constructional fields the encouraging feature is a measurable increase in private work. Pennsylvania State road programs are running well behind seasonal schedules this year, owing to postponement of the allocation of funds from the Federal works relief bill. Exceptionally favorable crop reports augur well for freer movement of tin plate stocks accumulated at mill warehouses. Tin plate operations have slipped moderately to 65 per cent. Sheet operations are holding up rather well and this week will average between 48 and 50 per cent. Hot-rolled strip steel production is unchanged at around 30 per cent.

Despite the renewed threat of a bituminous coal strike, fuel markets remain inert and both shipments and production have fallen sharply since mid-June.

Pig Iron

Foundry melt is tapering, and schedules soon will be reflecting the usual low summer rate. Some foundries next week will be down entirely for semi-annual repairs. Steel-making grades are not an exception to the general rule. Few contracts have been negotiated for third quarter.

Semi-Finished Steel

Reduced movement of automotive steel has adversely affected sheet bars and forging stock. Sheet bars for tin plate conversion also are slower as a consequence of declining operations among non-integrated tin plate mills. The steady movement of skelp is a feature of this market. With third quarter prices already established at unchanged bases, detached mills are slow to enter forward commitments. Prices are being rigidly observed, and the early threat of irregularities following the Supreme Court's decision has practically disappeared.

Bolts, Nuts and Rivets

Releases against second quarter contracts are few and third quarter contracting has not yet been active. The automobile industry is curtailing its requirements of nuts and bolts, while the railroads are ordering chiefly for spot maintenance needs. Prices appear to be a trifle firmer.

Reinforcing Steel

Slow progress in launching Allegheny County Authority work and the deferment in spending of Federal relief works money has retarded activity in this market. Ambitious State road programs, which had been hinging upon allocations from the Federal works bill, consequently are facing further delays. The only present ray of cheer is a noticeable improvement in small-lot private projects. Regardless of vague reports of deviations in prices, the Pittsburgh base price of 2.05c. a lb. quoted by distributers is quite firm.

Cold-Finished Bars

While automotive specifications continue to shrink, spot orders from other sources, notably from miscellaneous consumers, are holding volume for June virtually on a par with May business. Plans of the automotive industry to launch its 1936 models earlier this year will be of considerable help to the cold finished industry in offsetting the usual summer lull. Sustained schedules at some farm implement and machinery plants also augur well for contra-seasonal flow of orders for cold-finished material. Jobbers are ordering only to piece out stocks. Prices are firm.

Plates and Shapes

Important barge lettings continue to hinge chiefly on suitable financial arrangements, and in the event funds are made available for all pending inquiries, a substantial tonnage of plates and small shapes should materialize within the next few months. Potential barge buyers have forsaken the second-hand barge market, which appears to be bare of interesting tonnage.

Structural steel awards reported in this district for the past week showed a sharp upturn. The American Bridge Co. has been awarded 8500 tons for Grand Coulee construction trestles in Washington. Pittsburgh-Des Moines Steel Co. has received an order for 725 tons for a cement plant at that project. New inquiry also increased, with private work appearing in encouraging volume. At East Liverpool, Ohio, Hall China Co. will require 275 tons for plant alterations. Prices for plain structural material are well maintained.

Sheet Steel Piling

Bids soon will be requested for another section of the Monroe, La., river wall, which is expected to be larger than the first section which will need about 1700 tons. Another dam job is being figured for construction at Winfield, W. Va., by the Huntington, W. Va., Engineer office. Original bids on this job have been rejected, and opening of new bids will be delayed 30 days after receipt of revised specifications. A substantial tonnage of sheet piling will be specified.

Tubular Products

Fairly active drilling in the Gulf Coast and east Texas oil fields has sponsored a steady and relatively substantial flow of drill pipe, tubing and casing. Otherwise the tubular market offers little feature, excepting perhaps a slightly better demand for stationary pipe. Mechanical tubing is moving in reduced volume to the automotive industry. Demand for locomotive boiler tubes remains in the car-lot class. Pipe mill operations in this district are averaging around 35 per cent. The uneconomic features of several natural gas line projects for which it is planned to obtain Federal funds evidently are being

overlooked by the sponsors. Most trunk lines are at present carrying only 45 to 50 per cent load, and are considered sufficient to handle present needs for natural gas in most consuming centers. The only additional development that might economically be justified, according to surveys, is the installation of feeder lines at some congested consuming points.

Bars

Bar mills still are able to hold operations at a fairly even gait on the strength of a sustained flow of miscellaneous orders. Releases for automotive consumption continue to decline, but incoming tonnage from general sources, including the farm implement and machinery industry, is stemming a seasonal recession. All producers in this district are adhering firmly to current base quotations.

Wire Products

This market is existing on a day-to-day fare of small orders. Third quarter contracting has not resulted yet in a measurable volume of new tonnage. Seasonal demand for wire fencing is in swing, but orders from the farm regions are not in great evidence. The automotive industry has further narrowed its demand for manufacturers' wire, and it will be some weeks before new specifications for 1936 models are expected to reach wire mills.

Sheets

Demand is manifesting unusual staying powers, although reduced specifications and new orders are forcing moderate curtailment at some mills. Leading producers in this district report sustained volume of miscellaneous orders, with recent automotive releases an important factor. Sheet output this week will average only a shade lower at 48 to 50 per cent. Holiday interruptions next week foreshadow a more abrupt drop.

The Inland Steel Co., Chicago, has filed prices on enameling sheets of 2.60c. a lb. for No. 10 gage, and 3.20c. for No. 20 gage, at Gary, or at a 10c. a 100 lb. differential over the Pittsburgh base. The filing of these prices follows the establishment of that producer as a regular source for enameling sheets.

Tin Plate

Stocks of tin plate at mill warehouses are beginning to move more freely with the placing of heavier releases. Congestion at some points still is directly affecting mill operations, and until full demand for the early crops materializes stocks will be cumbersome. Unusually favorable crop reports portend substantial relief from the present conditions, with further moderate assistance not unlikely from the increasing distribution in domestic markets of canned malt beverages. Tin plate operations in the present week probably will not average more than 65 per cent.

Strip Steel

Specifications and orders have fallen off noticeably in the past week, and mill schedules are showing the effects of the reduced demand. Hot mill production is estimated to be not better than 30 per cent, while cold rolled output is hovering around 35 per cent. The lack of automobile tonnage is the principal depressing influence. Early orders from the motor car industry for its 1936 models are expected to be placed within three weeks for later delivery. At present, third quarter requirements from any source have barely been touched.

Coke and Coal

This market is marking time, pending further developments in legislation affecting the bituminous industry and the impending coal strike, which is postponed until June 30. Consumers have grown indifferent to offerings of coal and coke in anticipation of a shutdown, and production and shipments in the past fortnight have slumped sharply. No further disturbance is reported in the price situation, and all current quotations are nominally held.

Scrap

This market is drifting in no particular direction, with consumers and dealers generally inactive. The gradual downward course of steel output in this district has kept scrap consumption on a fairly steady basis, and inventories are not expected to be unusually husky at the beginning of second half. Prospect of further curtailment in mill activity during the holiday week will probably postpone any significant purchases until the middle of July. The leading steel mill in this district has offered for sale about 3000 tons of armor plate scrap, with 3.25 to 3.75 per cent nickel content.

Steel Demand Holds Up Well In Youngstown District

YOUNGSTOWN, June 24. — Valley steel activity at the close of the second quarter is at a fairly even pace. Unexpected spurts in demand from miscellaneous sources, surprisingly heavy releases from automotive centers and contraseasonal calls from farm implement and machinery makers have forestalled a notable recession in this market. In the current week raw steel output probably will be largely unchanged, although there is a good chance that additional open-hearths will become active in anticipation of finishing mill shutdowns during the Fourth of July week. A noticeable drop in ingot production, therefore, is in the wind for the first week of the second half, when many finishing units will find it uneconomical to operate for only the three days following the holiday.

Current activity is fairly well spread among the finishing mills, with pipe and structural steel units running slower than the average rate. Tin plate mills are leading, with those at Warren scheduled at capacity for this week. Sheet and strip mill schedules still are well fed by automotive orders, while hot-rolled bar and alloy bar mills are sustained largely on the same diet. Pipe mills are faring a little better this month as a result of an improved demand for standard pipe and increased calls for drill pipe and casing from the oil fields. Line pipe is virtually neglected.

Of encouragement to Valley producers at the outset of the second half is the disappearance of pressure for lower prices. At the moment there appears to be nothing in sight to disturb the third quarter price structure, and if the intention of sellers here is fulfilled, no deviations either from code practices or quotations will be made for the coming quarter. Adherence to code provisions is considered by some steel executives in this district to be legally binding, since certain contractual aspects of the code have been interpreted as remaining effective regardless of the Supreme Court's decision. The 60-day cancellation clause, to be exercised by the President before the steel code would have been declared at an end, has not yet been entirely clarified and remains the moot point in discussions here.

The Valley scrap market remains a quiet affair. Heavy melting steel is in small demand, but is momentarily resisting lower levels and is holding at around $12, delivered. Production scrap, including machine shop turnings, is more readily available, although recent sales at prices lower than previous levels are not reported.

Ingot Rate Rises to 41 Per Cent at Chicago

Demand Shows Unexpected Gain—Structural Prospects Brighter—Charcoal Iron Prices May Be Advanced

CHICAGO, June 25.—Improvement in specifications during the past two weeks is now reflected in ingot output which has advanced one and one-half points to 41 per cent of capacity. Rather a remarkable thing about the situation is that new buying, practically all in small lots, is also improved.

The Chesapeake & Ohio has ordered its cars and, out of the total, 1500 steel hopper cars will be built by a Chicago shop. Local steel mills will benefit to the extent of about 20,000 tons of rolled sections. Fifty stock cars will also be built in Chicago.

Demand for structural steel is improving and shops here count on about 95,000 tons of potential business, of which 45,000 tons is in sight now. The trade is disappointed over Government action which is delaying awards on the Mississippi River projects. No explanation seems to be available, though it is thought that these projects are being studied in the light of the balance between the cost of labor and materials.

Some increased business is reaching mills from automobile plants. However, this cannot be expected to last because all reports are to the effect that automobile production is gradually receding and will not turn up again until about the first of August.

Prices for scrap appear to have more stability, though buyers show no signs of becoming more active. Low prices have checked the flow, and some surplus tonnage is finding its way to docks along the west shore of Lake Michigan.

Pig Iron

Shipments are slower under the leadership of automobile foundries, which will not increase schedules until about Aug. 1. Stove and furnace units are badly mixed as to output, many being down for the summer period. Prices for charcoal iron are strong and price advances of from 50c. to $1 a ton are possibilities. The rising costs of assembling materials, as well as the narrow spread between charcoal and coke iron prices, are the main factors that are bearing on the price situation.

Reinforcing Bars

Business in reinforcing bars is dull and fresh inquiries are dragging except for tonnages of small size. The Conservation District of Northern Ohio is relocating railroad tracks and will use 600 tons. Additional tonnages will be needed at a later date. The 1000 tons for the Kansas City school will probably be purchased this week, and 1000 tons for an Indianapolis, Ind., housing project is near the buying stage. It is reported that one of the Chicago housing projects has been dropped because of manipulation of land values. Prices appear to have a stronger tone.

Cast Iron Pipe

Foundry backlogs are shrinking fast while private work remains dull and public projects lag for reasons that are typical when the Government lends a hand. It is reported that many water works are planned, but there is no way of telling at this time when those tonnages will come to the rescue of the cast iron pipe market. Chicago has split a 300-ton order for special fittings and offsets, Lynchburg Foundry Co., and James B. Clow and Sons, having taken the orders. Prices for cast iron pipe remain stationary.

Wire Products

Operations have been dropped to 45 per cent of capacity, which indicates that June shipments are running only about 15 per cent below the May rate. Producers report that a good hardware jobbers' trade is reflected on mill books. Wheat is now being harvested in Kansas, and most agricultural areas report favorable crop conditions. In some areas corn is slow because of lack of warm growing weather, and in the Mississippi Valley excessive rains have ruined some small grain crops and are preventing cultivation in corn fields. Floods and delay in allocating Federal funds are retarding road work and as a consequence very little reinforced concrete mesh is moving.

Plates

The plate market has received another setback with the announcement that all plans for dams and locks on the Mississippi River are to be delayed. About 1200 tons of steel, mostly plates, for use at the Wheeler Dam have been taken by a Milwaukee fabricator.

Rails

Railroads have now taken required emergency rails, and mills have settled back to steady operations, which unless again speeded to meet unusual conditions will continue at the present rate until about the middle of August. No active inquiries are now before the trade. The threat of a strike in the coal industry has accomplished nothing in the way of bringing in heavier orders for light rails. New orders and releases of accessories are heavier than at any time in the past year.

Sheets

Releases are slightly heavier and sheet mills will again operate through the week end. This influx of business is not traceable to any one or a few of the major consumers but comes from many directions, some of which would ordinarily be expected to diminish needs at this time of year. Demand from automobile plants is little changed, and local mills cannot trace any part of shipments to body plants where the sheets might be used for 1936 models.

Bars

Farm equipment manufacturers are now well under way with harvesting machinery programs, which will be continued for several months. In most other directions demand for bar mill products is slackening, this being noticeable now in the miscellaneous trade. Use for railroad equipment, both in contract and railroad shops, is very light.

Structural Material

Chicago district fabricators now estimate prospective tonnage at 94,000 and they count as active at this time not less than 44,000 tons. The five locks and four dams that are to be built on the Mississippi River account for 15,000 tons of structural material, 14,000 tons of piling and 6000 tons of reinforcing bars. Change in design of the Fort Peck retaining wall has resulted in bids having been thrown out on 8700 tons of steel piling. Actual

awards total about 5000 tons, and new inquiries are for 6500 tons.

Scrap

A large list, including 50 cars of heavy melting steel, being offered by the Milwaukee road, is about the most active thing in this market. Buyers are standing pat, and dealers and brokers are concentrating on old orders. Current low prices have checked the flow of scrap, and once again the threat of distress tonnages has been removed. Some heavy melting steel is now moving to local docks, while at Lake ports north of Chicago borings, turnings and busheling are being accumulated in liberal quantities for eventual shipment to Lake Erie ports. Dealers show a strong disposition to hold yard accumulations and to buy in the market such tonnages as are needed to fill old commitments on heavy melting steel, some of which were made at the $10.75 level.

Another Blast Furnace Taken Off in South

BIRMINGHAM, June 25. — Current bookings of pig iron and steel are still confined mostly to miscellaneous spot orders. Customers are not inclined to stock at this time, neither are they making commitments for the third quarter. The amount of third quarter tonnage on hand is comparatively small. There has been a fair run of spot business, sufficient to maintain the current rate of operations.

Open-hearth operations have remained unchanged during the past two weeks, with six units active. The same number will be worked this week. However, there was a further decline in blast furnace operations last week, when Ensley No. 6 furnace of the Tennessee Coal, Iron & Railroad Co. was blown out on June 19. This furnace was continued for about a week after all other Ensley operations had been stopped. The active total for the district is now seven stacks. The Tennessee company, Republic Steel and Woodward Iron each have two active stacks and Sloss-Sheffield one. Five are on foundry iron, one on basic and one on high silicon. The Tennessee company has changed one of its Fairfield furnaces to basic, while during the present week Republic will change the furnace now on high silicon back to foundry.

On June 22 the Tennessee company opened its model steel-clad homestead for inspection. This consists of a five-room dwelling, two-car garage, barn, poultry house and corn crib, with steel sheathing replacing lumber.

New England Foundry Outlook Brighter

BOSTON, June 25.—The pig iron market is somewhat more active, indicating a brighter New England foundry outlook. Sales the past week approximated 1200 tons, made up of small lots, mostly Buffalo, Indian and Dutch brands. Indications are June pig iron sales will be better than for some months. Some foundries, notably machine tool, are quite busy, others are fairly active, and the remainder have casting orders in the making.

A steamer is here loading 5000 tons of railroad scrap for Rumania, and another is preparing to sail for Italy with 5500 tons of No. 1 and No. 2 steel. Exports from Providence, R. I., have been held up because of belated arrivals of boats. Two sizable cargoes are scheduled to load there this month, and at least one and possibly two cargoes will move in the first half of July. Local exports for June to the 18th, inclusive, were 12,903 tons. The general export price on No. 1 steel is $8.50 a ton, delivered army base, but $8.75 was paid the past week, while the market for No. 2 steel is firmer at $7.50 to $7.75 a ton. The scrap market for Pennsylvania deliveries is inactive.

New England by-product foundry coke ovens have opened their books for last half contracts. The price for foundry coke is unchanged, but for domestic is 25c. a ton higher, effective July 1.

Wabash Rail Order Is Feature at St. Louis

ST. LOUIS, June 25.—The Wabash Railway has purchased 5000 tons of 112-lb. rails for July and August delivery, which was allocated as follows: Illinois Steel Co., 2500 tons; Inland Steel Co. and Bethlehem Steel Co., 1250 tons each.

The Missouri Pacific Railway has made no plans to exercise the authority granted its trustees by the Federal Court here to purchase 10,000 tons of steel rails.

The Federal Court has authorized the local public service company to expend $550,234 to reconstruct 14.72 miles of street car track on account of worn-out rails, the funds for which are not yet available.

Abandoning the idea of using an old bridge, the Missouri Highway Commission has rejected bids for approaches, requiring 396 tons, and will prepare plans for a new bridge across the Meramec River, connecting St. Louis and Jefferson counties.

Bids are expected to be asked within the next few months for a number of grade crossing elimination projects in Illinois, whose highway department at Springfield has added a large staff to prepare plans for them.

The movement of galvanized sheets and wire products is said to have been halted because of rains. Stove manufacturers are buying more liberally of material than usual at this time of year.

Shipments of pig iron have been well maintained, but sales are slowing down. The melt of the stove foundries is holding up fairly well, operations being considerably ahead of what they usually are at this time of year.

The scrap market is very quiet. Mills are not buying, and not a great deal is being offered to dealers. Prices are unchanged.

Output Holds At Buffalo

BUFFALO, June 25.—Ingot output is unchanged from last week, with Bethlehem's Lackawanna plant operating eight open-hearth furnaces; Republic Steel Corpn., three, and Wickwire-Spencer, one. The Seneca sheet division of Bethlehem is running at about 65 per cent of capacity.

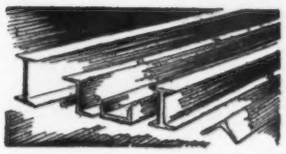
A Buffalo fabricator has received the contract for 1000 tons of structural steel work for the new Olean high school. Other structural awards this week were less than 100 tons apiece, but there were several small ones.

In scrap about the only activity was a number of sales of short rails at $13.50 outside the city. The principal consumer has not changed its offering price of $10.50 for No. 1 steel, but this price is also being offered by the dealers, who are intent on accumulating yard stocks. The mill has obtained some small tonnages based on this figure. Its receipts have been mostly old bundles, which it takes in at $8.

The pig iron market remains quiet, with a flow of small lots.

Republic Steel Corpn. has placed an order with the Westinghouse Electric & Mfg. Co. for motor and control equipment, to cost approximately $100,000, for a new 42-in. reversible cold strip mill at its Warren, Ohio, mill.

Philadelphia District Output Declines to Only 30 Per Cent



Placing of Large Sheet Order for Automobile Frames Is Feature of Otherwise Dull Market

PHILADELPHIA, June 25.—An eastern Pennsylvania mill has received an order for 35,000 to 40,000 tons of hot-rolled sheets to be used in the fabrication of Chevrolet automobile frames by the Edward G. Budd Mfg. Co., Philadelphia. The contract is understood to call for the prevailing price of 1.85c., Pittsburgh, during the third quarter and for whatever price is being generally quoted during the remainder of the year.

Otherwise business is rather quiet in the immediate Philadelphia territory, although Government activity at Washington is attracting the attention of the steel industry here. Bids will be taken July 19 on an addition to the Department of the Interior building at Washington, which will require 20,000 tons of structural steel. About 9700 tons of shapes will be fabricated by the McClintic-Marshall Corpn. for the Library of Congress addition. This job will also take a large tonnage of sheets for shelving.

Philadelphia district mills will not likely share in the plates required by the 5125 freight cars awarded by the Chesapeake & Ohio railroad, all of which will be built in the Pittsburgh and Chicago districts. The Norfolk Southern will build 500 box cars in its own shops.

Steel prices seem to be well maintained, although buyers are cautious and in some instances are allowing their stocks to dwindle, rather than purchase material for their day-to-day needs. Opening of bids on 990 tons of plates for the Navy Department in Washington on June 18, revealed price discrepancies which were attributed to errors. Variations in delivered prices ranged from $4 to $8 a ton, and the department has not yet announced whether or not the erroneous tenders have been withdrawn.

Steel ingot production on the part of independent mills is unchanged, but the leading interest has curtailed output slightly in the Philadelphia district and the ingot rate this week is estimated at 30 per cent of capacity, a decline of one point.

Pig Iron

This market is very dull with orders confined to carlots for immediate delivery and scarcely any interest in third quarter iron. The holiday next week is giving many foundries an opportunity to shut down and some will be closed for indefinite periods. Cast iron pipe producers are operating only two or three days a week and are not in the market for iron. The Library of Congress addition at Washington will require 1500 tons of steel castings. The Colonial Iron Co., Riddlesburg, Pa., has begun to make repairs to its furnace preparatory to resumption of operations. The company has been granted a Federal loan of $110,000.

Bars, Plates and Shapes

With construction activity at a low ebb in this territory, demand for structural steel and reinforcing bars is very light. No large projects are in prospect and the district does not expect to share heavily in forthcoming PWA allotments. The largest inquiry before the trade is the Interior Department annex at Washington which will take 20,000 tons of shapes. McClintic-Marshall Corpn. will fabricate 9700 tons of shapes for the Library of Congress addition and Chicago Bridge & Iron Co. has taken 550 tons of plates for bulk storage tanks for the Atlantic Refining Co. in Pennsylvania. Otherwise plate demand is quiet, although a round tonnage will be needed for 500 box cars which the Norfolk Southern railroad will build in its own shops. Shipyards see no new business in prospect and the largest interest is still closed by a strike. The Navy Department has not yet awarded 990 tons of plates for a number of Navy yards on which bids were taken June 18. This department will take bids July 5 on 148 tons of stainless steel.

Sheet and Strip

The placing of 35,000 to 40,000 tons of hot-rolled sheets for Chevrolet frame fabrication by the Edward G. Budd Mfg. Co. is the feature of this market. An eastern Pennsylvania mill is reported to have taken the business at the full quoted price of 1.85c., Pittsburgh. These frames have hitherto been furnished by a Western fabricator, but it is believed that the General Motors policy of wide distribution of its parts manufacture may result in continued sharing in the business by local firms. The sheet market is otherwise very quiet and strip demand is very limited. Radio manufacturers are not yet in the market and jobber buying is negligible.

Scrap

The market is characterized by an almost complete lack of interest in No. 1 heavy melting steel and active demand for the No. 2 grade. At least four mills are taking shipments on No. 2 steel and dealers are paying $9 freely to cover on old orders. On the other hand, No. 1 steel for export is bringing only $9.50 and the order at Claymont for which $10 has been paid recently is largely cleaned up. This mill is now interested only in bargain lots. Machine shop turnings are strong and stove plate is more active. Chemical borings are weaker.

Rate Unchanged In Southern Ohio

CINCINNATI, June 25.—Efforts of mill interests to hold the market on an even keel since abolition of code regulation are meeting with success. Buyers generally are making no raid on price structures, but are steadily purchasing for current needs at published schedules. New business, the past week, was equal to about 50 per cent of capacity and assured the retention of present rolling schedules for another week. Better than anticipated production in electrical refrigerator plants is sustaining sheet demand above the seasonal level, while galvanized sheets are reacting to an almost capacity demand.

Pig iron buyers are taking metal at steady rate for immediate use and average bookings fluctuate around 500 tons a week.

Mill rejections have added to the general apathy toward purchases of scrap. Confidence of dealers in future possibilities, however, is sustaining prices. Dealer activity is restricted by lack of finances, which also might force quantities of distress material into the market before mill needs appear.

Large Railroad Car Order Features Cleveland Market

C. & O. Buys 5125 Freight Cars—Steel Demand Well Maintained—Ingot Output Holds at 41 Per Cent

CLEVELAND, June 25.—With a fair amount of business from automotive and other sources, demand for finished steel is holding up well. While there was some expectation of a gradual seasonal tapering in June, tonnage booked by some of the mills in this territory will be about the same as during May. Ingot output in the Cleveland-Lorain territory is unchanged at 41 per cent of capacity for the third successive week. Fresh orders permitted sheet and strip mills in Cleveland to increase operations this week.

The Chesapeake & Ohio Railroad has placed its orders for 5125 freight cars, which will take 60,000 to 65,000 tons of steel. Specifications for wheels, axles and other accessories will be issued by the railroad during the week of July 7 and some of the plate and shape tonnage for the cars is expected to reach the mills at about the same time.

Considerable business in sheets and strip steel and bars is still being placed by plants in this territory making parts for the low-priced automobiles. Bars continue to move well to agricultural implement manufacturers.

New inquiry is light in the construction field, although considerable public work is awaiting awards. Uncertainty prevails regarding grade crossing elimination work owing to the restrictions placed by the Government on the money that can be used for materials for work relief projects.

Doubts in consumers' minds whether recent prices would be maintained after the elimination of the NRA seem to have almost entirely disappeared. No concessions are reported on any steel products, and some business is now coming out that was held back because of temporary uncertainty regarding prices.

Pig Iron

Demand shows an upward trend from makers of castings for oil country goods and from some manufacturers of railroad castings, orders for which are being stimulated by car repair work. There is little new business from the automotive industry, and operations are tending downward in foundries specializing on motor castings, as well as with other jobbing foundries. New business generally is slow and sales usually are for small lots, although one 1000-ton inquiry is pending. A leading Lake furnace interest sold 3000 tons during the week. June sales and shipments are about 10 per cent lower than in May.

Iron Ore

Increased activity of the Lake fleet indicates a gain in ore shipments this month over May. There were 164 bulk freighters in commission June 15, or 50.62 per cent of the total, as compared with 152 on May 15, or 46.91 per cent of the total. On June 15 last year 205 were in commission, or 62.50 per cent of total. Based on tonnage, the fleet was operating June 15 at 55.71 per cent of capacity as compared with 52.36 per cent on the same date last year. There were 141 boats in the ore trade June 15, as compared with 120 May 15 and with 154 on June 15 last year.

Sheets

Enameling sheets are moving in better volume than recently to manufacturers of washing machine tubs, who are preparing to bring out new models. Refrigerator manufacturers, who are drawing to the close of their production schedules, are not placing new business. Business from the automobile industry is growing lighter, although stamping plants in this territory continue to order sizable lots for automobile parts. New bookings, largely from automotive sources, enabled a local mill to increase operations this week to 85 per cent of capacity. Orders from miscellaneous consumers are fair. Part of this business evidently backed up after the NRA decision, when some consumers deferred buying to see if there would be any unsettling of prices. Niles Rolling Mill Co., Niles, Ohio, will begin operation of its remodeled plant July 15, with enameling sheets as its principal product at the start.

Strip Steel

Demand continues rather light, although some new business has come from makers of household utensils. Little business is being placed by automobile manufacturers, and some leading automobile parts plants remain out of the market. Fair orders for hot strip are coming from the cold rolling plants. The local cold rolling strip mill is operating at 40 per cent of capacity this week, a gain over last week.

Bars, Plates and Shapes

Merchant bars continue to move in satisfactory volume to automobile parts manufacturers and to miscellaneous consumers. Awards in the construction field include 1037 tons of reinforcing bars for a Federal housing project in Cleveland and 1020 tons of sheet steel piling for public work. Bids are being taken this week for several projects in the Muskingum Conservancy District requiring considerable tonnage of shapes and reinforcing bars. The Erie railroad is expected to have some bridge work out shortly. Orders for plates in car lots from boiler and tank shops have improved.

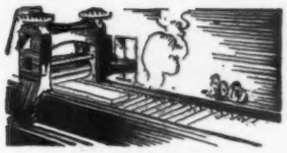
Railroad Equipment

The Chesapeake & Ohio Railroad has placed 5125 freight cars, which were divided between five builders. This road took bids Monday for five locomotives. The Chesapeake & Ohio and also the Erie took bids this week for their requirements in steel bars, plates and shapes for the third quarter.

Scrap

New consumer demand is lacking and little activity is expected in the next few weeks, or until present stocks are used up. Restrictions on shipments have been lifted in the Youngstown district. Prices are steady and unchanged. Dealers are paying $11.50 for No. 1 heavy melting steel and $10.50 for No. 2, for delivery in the Youngstown district, and $7 for blast furnace grades, delivered to a Cleveland consumer.

Steel Demand Tapers In New York Area



Recession Is Little More Than Seasonal and No Deviations From Ruling Prices Have Been Uncovered

NEW YORK, June 25.—Demand for finished steel continues to show a slow seasonal decline, accentuated to some extent by reluctance on the part of buyers to close pending business. Postponement of action on purchases, however, has thus far failed to bring out any concessions from ruling quotations. Prices are still soft on fabricated steel contracts, but this is nothing new since the structural steel business was never under a code.

Shipping releases on tin plate have improved somewhat, although mills are still handicapped because of excessive stocks in warehouses. As soon as can companies get a better idea of the size of packs they are expected to take shipments in considerably larger volume.

The Naval appropriation bill, calling for 24 new war vessels of which half will be built in private yards and half in Navy yards, has been passed by both Houses and is now in conference. It is believed that the bill will be enacted soon enough so that invitations can be sent out for bids some time in July. The Navy is also expected to receive an allotment for a floating dry dock, as well as a considerable sum for shore protection work.

Although the State of New York has been advised of its allotment of Federal money under the works relief law, the provision requiring 40 per cent of the appropriation for each job to be expended for labor at the site has introduced an unexpected complication, holding up contemplated projects for the time being.

The New York Central will take Clayton Act bids for its third quarter requirements on July 2. Bids received by the State of New York for 700 tons of steel for automobile license tags were rejected and mills have been asked to submit new figures on a strip basis. The steel for the Manhattan approach to the Thirty-eighth Street tunnel has not yet been purchased. It is understood that the tunnel engineers have recommended steel instead of cast iron for the tunnel lining in the approach. This will require 935 tons of steel in addition to the 2500 tons of fabricated structural steel for the remainder of the approach. Bids will be taken June 27 on the Bronx approach to the Triborough bridge, requiring 9500 tons of structural steel.

Snead & Co., Jersey City, have the general contract for the book racks for the Library of Congress addition at Washington. About 500 tons of sheets will be required in addition to unspecified quantities of castings, plates and shapes. The fabricating contract for the Tottenville, Staten Island, high school, requiring 1100 tons, was erroneously reported as awarded last week. Psaty & Fuhrman, Inc., the general contractor, has not yet closed for the steel.

Pig Iron

Buying has improved during the last seven days, sales being estimated at 2100 tons, compared with only 1000 tons in the preceding week and 1150 tons in the previous period. Practically all orders are for immediate delivery, although a little tonnage has been booked for third quarter. Many foundries will not operate next week because of the holiday and others will remain closed for a longer period. Prices remain firm, although foreign competition is troublesome. Dutch iron is still being offered at prices averaging about $1 a ton under the prevailing market. The Russian iron at Port Newark is also beng offered at corresponding concessions. It is reported that the Troy, N. Y., furnace will not operate this summer, but the Tonawanda stack of the American Radiator Co. will probably be blown in during August. The Colonial Iron Co.'s furnace at Riddlesburg, Pa., will also begin operations soon.

Reinforcing Bars

This market is very quiet, and has been adversely affected by the conflicting reports from Washington concerning the spending of works relief funds. Large allocations for road building and grade crossing elimination may be rescinded if the President's latest mathematical formula is followed. Tully & Di Napoli, Inc., has awarded 230 tons of bars for the Tri-borough Bridge approach to Truscon Steel Co. Highway work in Queens and Erie counties, N. Y., still is pending, and the P. T. Cox Contracting Co. has not yet placed 1800 tons for Baltimore & Ohio grade crossing eliminations in Staten Island, N. Y. About 1400 tons of bars required for the Midtown Tunnel approach in New York will not likely be awarded by the Cornell Contracting Corpn. until next week.

Scrap

The dullness of the scrap market has been accentuated by the total absence of Japanese demand. Brokers do not expect any early resumption of activity from this important outlet and keen competition has developed on such other export business as is available. Italy remains as the largest possible customer. No scrap price changes have been reported and brokers are still paying as high as $7.50 for No. 2 steel in large lots for export. Small tonnages are available at $7.

Pipe Lines

Cortez Oil Co., Trinity Life Building, Fort Worth, Tex., has let contract to Hope Engineering Co., 30 Broad Street, New York, for 10 and 6-in. crude oil welded steel pipe line from new Sanfordyce oil field district, Hidalgo County, Tex., to terminals under construction at Brownsville and Port Isabel, Tex., about 25 miles. Installation will include steel pipe line gathering system in oil district noted. Cost about $500,000. Cortez company will soon establish headquarters at Mission, Tex.

Alva M. Drake, 2420 Humboldt Avenue South, Minneapolis, Minn., representing group of independent natural gas operators in Montana field, has tendered a proposition to furnish natural gas for commercial service at Duluth, Chisholm and Hibbing, Minn., and city councils of these municipalities are favoring project. Welded steel pipe line is proposed from Montana to points noted, with steel pipe lines for local distribution. Cost about $30,000,000. It is proposed to arrange financing through Federal aid. John W. Schmidt, Anoka, Minn., is also interested in project.

New York Central Railroad Co., 466 Lexington Avenue, New York, asks bids until July 2 for steel pipe, steel tubing (Contract 9-1935). C. C. Warne is purchasing agent.

George E. Poulter, San Angelo, Tex., is at head of project to build steel pipe line about 40,000 ft., from natural gas fields near Brady, Tex., for gas service at that place; steel pipe line distribution system will be installed in municipality. Cost close to $100,000.

Keystone Pipe Line Co., a subsidiary of Atlantic Refining Co., 260 South Broad Street, Philadelphia, is completing surveys for welded steel pipe line from Mechanicsburg, Pa., to Pittsburgh, about 180 miles, for gasoline service. Line will connect at first noted point with existing steel pipe line of company from refinery at Point Breeze, near Philadelphia, source of supply. Contract for 8⅝-in. steel pipe for new line has been let by parent organization to National Tube Co., Pittsburgh, as recently reported in these columns.

Fort Smith, Ark., is inquiring for 6500 tons of 26-in. pipe for a water system. Williams Brothers, Tulsa, Okla., is general contractor.

Prices of Finished Steel and Iron Products

BARS, PLATES, SHAPES

Iron and Steel Bars

Soft Steel — *Base per Lb.*

F.o.b. Pittsburgh	1.80c.
F.o.b. Chicago	1.85c.
F.o.b. Gary	1.85c.
F.o.b. Duluth	1.95c.
Del'd Detroit	1.95c.
F.o.b. Cleveland	1.85c.
F.o.b. Buffalo	1.90c.
Del'd Philadelphia	2.11c.
Del'd New York	2.15c.
F.o.b. Birmingham	1.95c.
F.o.b. cars dock Gulf ports	2.20c.
F.o.b. cars dock Pacific ports	2.35c.

Rail Steel

(For merchant trade)

F.o.b. Pittsburgh	1.70c.
F.o.b. Chicago	1.75c.
F.o.b. Gary	1.75c.
F.o.b. Moline, Ill.	1.75c.
F.o.b. Cleveland	1.75c.
F.o.b. Buffalo	1.80c.
F.o.b. Birmingham	1.85c.
F.o.b. cars dock Gulf ports	2.10c.
F.o.b. cars dock Pacific ports	2.25c.

Billet Steel Reinforcing

(Straight lengths as quoted by distributers)

F.o.b. Pittsburgh	2.05c.
F.o.b. Chicago	2.10c.
F.o.b. Gary	2.10c.
Del'd Detroit	2.20c.
F.o.b. Cleveland	2.10c.
F.o.b. Youngstown	2.10c.
F.o.b. Buffalo	2.10c.
F.o.b. Birmingham	2.10c.
F.o.b. cars dock Gulf ports	2.45c.
F.o.b. cars dock Pacific ports	2.45c.

Rail Steel Reinforcing

(Straight lengths as quoted by distributers)

F.o.b. Pittsburgh	1.90c.
F.o.b. Chicago	1.95c.
F.o.b. Gary	1.95c.
F.o.b. Cleveland	1.95c.
F.o.b. Youngstown	1.95c.
F.o.b. Buffalo	1.95c.
F.o.b. Birmingham	1.95c.
F.o.b. cars dock Gulf ports	2.30c.
F.o.b. cars dock Pacific ports	2.30c.

Iron

F.o.b. Chicago	1.80c.
F.o.b. Terre Haute, Ind.	1.75c.
F.o.b. Louisville, Ky.	2.10c.
F.o.b. Danville, Pa.	1.80c.
F.o.b. Berwick, Pa.	1.70c.

Cold Finished Bars and Shafting*

Base per Lb.

F.o.b. Pittsburgh	1.95c.
F.o.b. Chicago	2.00c.
F.o.b. Gary	2.00c.
F.o.b. Cleveland	2.00c.
F.o.b. Buffalo	2.05c.
Del'd Detroit	2.15c.
Del'd eastern Michigan	2.20c.

* In quantities of 10,000 to 19,000 lb.

Fence and Sign Posts

Angle Line Posts

Base per Net Ton

F.o.b. Pittsburgh	$50.00
F.o.b. Chicago	50.00
F.o.b. Duluth	51.00
F.o.b. Cleveland	50.00
F.o.b. Birmingham	53.00
F.o.b. Houston, Orange, Beaumont, Galveston	59.00
F.o.b. Mobile	58.00
F.o.b. New Orleans, Lake Charles, Corpus Christi	59.00
F.o.b. cars dock Pacific ports	63.00

Plates

Base per Lb.

F.o.b. Pittsburgh	1.80c.
F.o.b. Chicago	1.85c
F.o.b. Gary	1.85c.
Del'd Cleveland	1.995c.
F.o.b. Coatesville	1.90c.
F.o.b. Sparrows Point	1.90c.
Del'd Philadelphia	1.99c.
Del'd New York	2.09c.
F.o.b. Birmingham	1.95c.
F.o.b. cars dock Gulf ports	2.20c.
F.o.b. cars dock Pacific ports	2.35c.
Wrought iron plates, f.o.b. P'gh	3.20c.

Floor Plates

F.o.b. Pittsburgh	3.35c.
F.o.b. Chicago	3.40c.
F.o.b. Coatesville	3.45c.
F.o.b. cars dock Gulf ports	3.75c.
F.o.b. cars dock Pacific ports	3.90c.

Structural Shapes

Base per Lb.

F.o.b. Pittsburgh	1.80c.
F.o.b. Chicago	1.85c.
Del'd Cleveland	1.995c.
F.o.b. Buffalo	1.90c.
F.o.b. Bethlehem	1.90c.
Del'd Philadelphia	2.015c.
Del'd New York	2.0625c.
F.o.b. Birmingham (standard)	1.95c.
F.o.b. cars dock Gulf ports	2.20c.
F.o.b. cars dock Pacific ports	2.35c.

Steel Sheet Piling

Base per Lb.

F.o.b. Pittsburgh	2.15c.
F.o.b. Chicago	2.25c.
F.o.b. Buffalo	2.25c.
F.o.b. cars dock Gulf ports	2.60c.
F.o.b. cars dock Pacific ports	2.60c.

SHEETS, STRIP, TIN PLATE TERNE PLATE

Sheets

Hot Rolled

Base per Lb.

No. 10, f.o.b. Pittsburgh	1.85c.
No. 10, f.o.b. Gary	1.95c.
No. 10, del'd Detroit	2.05c.
No. 10, del'd Phila.	2.16c.
No. 10, f.o.b. Birmingham	2.00c.
No. 10, f.o.b. dock cars Pacific ports	2.40c.

Hot-Rolled Annealed

No. 24, f.o.b. Pittsburgh	2.40c.
No. 24, f.o.b. Gary	2.50c.
No. 24, del'd Detroit	2.60c.
No. 24, del'd Phila.	2.71c.
No. 24, f.o.b. Birmingham	2.55c.
No. 24, f.o.b. dock cars Pacific ports	3.05c.
No. 24, wrought iron, Pittsburgh	4.30c.

Heavy Cold-Rolled

No. 10 gage, f.o.b. Pittsburgh	2.50c.
No. 10 gage, f.o.b. Gary	2.60c.
No. 10 gage, del'd Detroit	2.70c.
No. 10 gage, del'd Phila.	2.81c.
No. 10 gage, f.o.b. Birminghsm	2.65c.
No. 10 gage, f.o.b. dock cars Pacific ports	3.10c.

Light Cold-Rolled

No. 20 gage, f.o.b. Pittsburgh	2.95c.
No. 20 gage, f.o.b. Gary	3.05c.
No. 20 gage, del'd Detroit	3.15c.
No. 20 gage, del'd Phila.	3.26c.
No. 20 gage, f.o.b. Birmingham	3.10c.
No. 24, f.o.b. dock cars Pacific ports	3.50c.

Galvanized Sheets

No. 24 gage, f.o.b. Pittsburgh	3.10c.
No. 24, f.o.b. Gary	3.20c.
No. 24, del'd Phila.	3.41c.
No. 24, f.o.b. Birmingham	3.25c.
No. 24, f.o.b. dock cars Pacific ports	3.70c.
No. 24, wrought iron, Pittsburgh	4.95c.

Long Ternes

No. 24, unassorted 8-lb. coating f.o.b. Pittsburgh	3.40c.
F.o.b. Gary	3.50c.
F.o.b. cars dock Pacific ports	4.10c.

Vitreous Enameling Stock

No. 20, f.o.b. Pittsburgh	3.10c.
No. 20, f.o.b. Gary	3.20c.
No. 20, f.o.b. Birmingham	3.70c.
No. 20, f.o.b. cars dock Pacific ports	3.70c.
No. 10, f.o.b. Pittsburgh	2.50c.
No. 10, f.o.b. Gary	2.60c.
No. 10, f.o.b. Birmingham	3.10c.
No. 10, f.o.b. cars dock Pacific ports	3.10c.

Tin Mill Black Plate

No. 28, f.o.b. Pittsburgh	2.75c.
No. 28, Gary	2.85c.
No. 28, cars dock Pacific Coast ports	3.35c.

Tin Plate

Per Base Box

Standard cokes, f.o.b. P'gh district mill	$5.25
Standard cokes, f.o.b. Gary	5.35
Standard cokes, f.o.b. cars dock Pacific ports	5.90

Terne Plate

(F.o.b. Pittsburgh)

(Per Package, 20 x 28 in.)

8-lb. coating I.C.	$10.00
15-lb. coating I.C.	12.00
20-lb. coating I.C.	13.00
25-lb. coating I.C.	14.00
30-lb. coating I.C.	15.25
40-lb. coating I.C.	17.50

Hot-Rolled Hoops, Bands, Strips and Flats under ¼ In.

Base per Lb.

All widths up to 24 in., P'gh	1.85c.
All widths up to 24 in., Chicago	1.95c.
All widths up to 24 in., del'd Detroit	2.05c.
All widths up to 24 in., Birmingham	2.00c.
Cooperage stock, Pittsburgh	2.10c.
Cooperage stock, Chicago	2.20c.

Cold-Rolled Strips

Base per Lb.

F.o.b. Pittsburgh	2.60c.
F.o.b. Cleveland	2.60c.
Del'd Chicago	2.895c.
F.o.b. Worcester	2.80c.

Fender Stock

No. 14, Pittsburgh or Cleveland	2.90c.
No. 14, Worcester	3.36c.
No. 20, Pittsburgh or Cleveland	3.36c.
No. 20, Worcester	3.76c.

Hot-Rolled Rail Steel Strips

Base per Lb.

F.o.b. Pittsburgh	1.70c.
F.o.b. Chicago	1.75c.
F.o.b. Birmingham	1.85c.

WIRE PRODUCTS

(Carload lots, f.o.b. Pittsburgh and Cleveland.)

To Manufacturing Trade — *Per Lb.*

Bright wire	2.30c.
Spring wire	2.90c.

Chicago prices on products sold to the manufacturing trade are $1 a ton above Pittsburgh or Cleveland. Worcester and Duluth prices are $2 a ton above, Birmingham $3 above, and Pacific Coast prices $9 a ton above Pittsburgh or Cleveland.

To Jobbing Trade

Qualified jobbers are entitled to a reduction of 20c. a 100 lb. from the base price on carload shipments to stock, and of 10c. a 100 lb. on less-carload shipments to stock.

Base per Keg

Standard wire nails	$2.60
Smooth coated nails	2.60
Galvanized nails:	
15 gage and coarser	4.60
16 gage and finer	5.10

Base per 100 Lb.

Annealed fence wire	$2.45
Galvanized fence wire	2.80
Polished staples	3.30
Galvanized staples	3.55
Barbed wire, galvanized	3.00
Woven wire fence, base column	63.00

Chicago and Anderson, Ind., mill prices are $1 a ton over Pittsburgh base (on all products except woven wire fence, for which the Chicago price is $2 above Pittsburgh); Duluth, Minn., and Worcester, Mass., mill prices are $2 a ton over Pittsburgh (except for woven wire fence at Duluth which is $3 over Pittsburgh), and Birmingham mill prices are $3 a ton over Pittsburgh.

On wire nails, barbed wire, staples and fence wire, prices at Houston, Galveston and Corpus Christi, Tex., New Orleans, Lake Charles, La., and Mobile, Ala., are $6 a ton over Pittsburgh, while Pacific Coast prices are $8 over Pittsburgh. Exception: on fence wire Pacific Coast prices are $11 a ton above Pittsburgh.

On staples and barbed wire, prices of $6 a ton above Pittsburgh are also quoted at Beaumont and Orange, Tex.

Wire Hoops, Twisted or Welded

Off List

F.o.b. Pittsburgh	35 and 2½ off
F.o.b. Chicago	35 off

STEEL AND WROUGHT PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio Mills

F.o.b. Pittsburgh only on wrought iron pipe

Butt Weld

Steel Inches	Black	Galv.	Wrought Iron Inches	Black	Galv.
⅛	51½	29½	⅛	+91½	+138
¼ to ⅜	53½	35	¼ & ⅜	+1½	+21½
½	58½	47	½	31½	15
¾	62	52	¾	36½	20½
1 to 3	64	55	1 & 1¼	39½	25½
			1½	43½	28
			2	41½	26

Lap Weld

2	60	51	2	37	22½
2½ to 3	63	54	2½ to 3½	38	25
3½ to 6	65	56	4 to 8	40	28½
7 and 8	64	54	9 to 12	38	24½
9 and 10	63½	53½			
11 and 12	62½	52½			

Butt Weld, extra strong, plain ends

⅛	48½	33½	⅛	+13	+45½
¼ to ⅜	51	38	¼ & ⅜	+2½	+34½
½	56½	47½	½	32½	17½
¾	61	52	¾	37½	22½
1 to 3	63	55	1 to 2	43½	29

Lap Weld, extra strong, plain ends

2	58	50	2	40	26
2½ to 3	62	54	2½ to 4	45½	33
3½ to 6	65½	57½	4½ to 6	45	33½
7 and 8	64½	54½	7 & 8	46	33
9 and 10	63½	53½	9 to 12	41½	30
11 and 12	62½	52½			

On standard steel pipe an extra 5% off is allowed on sales to consumers while two 5's off apply on sales to jobbers. On less-than-carload shipments prices are determined by adding 20 and 25% and the carload freight rate to the base card. On structural steel pipe the base card is reduced 2 points and two 5's off are allowed to consumers and three 5's off to jobbers.

Note—Chicago district mills have a base two points less than the above discounts. Chicago delivered base is 2½ points less. Freight is figured from Pittsburgh, Lorain, Ohio, and Chicago district mills, the billing being from the point producing the lowest price to destination.

Boiler Tubes

Seamless Steel Commercial Boiler Tubes and Locomotive Tubes

(Net base prices per 100 ft. f.o.b. Pittsburgh, in carload lots)

		Cold Drawn	Hot Rolled
1 in. o.d.	13 B.W.G.	$ 8.60	$7.82
1¼ in. o.d.	13 B.W.G.	10.19	9.26
1½ in. o.d.	13 B.W.G.	11.26	10.23
1⅝ in. o.d.	13 B.W.G.	12.81	11.64
2 in. o.d.	13 B.W.G.	14.35	13.04
2¼ in. o.d.	13 B.W.G.	16.00	14.54
2¼ in. o.d.	12 B.W.G.	17.61	16.01
2½ in. o.d.	12 B.W.G.	19.29	17.54
2⅝ in. o.d.	12 B.W.G.	20.45	18.59
3 in. o.d.	12 B.W.G.	21.45	19.50
3½ in. o.d.	10 B.W.G.	41.08	37.35
3½ in. o.d.	11 B.W.G.	27.09	24.62
4 in. o.d.	10 B.W.G.	33.60	30.54
4½ in. o.d.	10 B.W.G.	41.08	37.35
5 in. o.d.	9 B.W.G.	51.56	46.87
6 in. o.d.	7 B.W.G.	79.15	71.96

Extras for less-carload quantities:

25,000 lb. or ft. to 39,999 lb. or ft.	5 %
12,000 lb. or ft. to 24,999 lb. or ft.	12½ %
6,000 lb. or ft. to 11,999 lb. or ft.	25 %
2,000 lb. or ft. to 5,999 lb. or ft.	35 %
Under 2,000 lb. or ft.	50 %

Lapweld Steel and Knobbled Charcoal Iron Pressure Tubes

(Net base prices per 100 ft. f.o.b. Pittsburgh, in carload lots)

		Steel	Iron
1½ in. o.d.	13 B.W.G.	$ 9.72	$20.16
1¾ in. o.d.	13 B.K.G.	11.06	21.84
2 in. o.d.	13 B.W.G.	12.38	17.23
2¼ in. o.d.	13 B.W.G.	13.79	19.58
2½ in. o.d.	12 B.W.G.	16.58	24.19
2¾ in. o.d.	12 B.W.G.	17.54	26.46
3 in. o.d.	12 B.W.G.	18.35	28.39
3¼ in. o.d.	11 B.W.G.	21.56	33.95
3½ in. o.d.	11 B.W.G.	23.15	36.16
4 in. o.d.	10 B.W.G.	28.66	45.36
4½ in. o.d.	10 B.W.G.	35.22	50.48
5 in. o.d.	9 B.W.G.	44.25	61.86
6 in o.d.	7 B.W.G.	68.14	102.46

Quantity Extras:

40,000 lb or ft.	base
25,000 lb. or ft. to 39,999 lb. or ft.	plus 5%
10,000 lb. or ft. to 24,999 lb. or ft.	plus 12½%
2,000 lb. or ft. to 9,999 lb. or ft.	plus 25%
Under 2,000 lb. or ft.	plus 40%

CAST IRON WATER PIPE

Per Net Ton

*6-in. and larger, del'd Chicago	$48.40
*4-in., del'd Chicago	51.40
6-in. and larger, del'd New York	45.20
4-in. del'd New York	48.20
*6-in. and larger, Birmingham	40.00
*4-in. Birmingham	43.00

Class "A" and gas pipe, $3 extra.

*Prices for lots of less than 200 tons. For 200 tons and over, 6-in. and larger is $39, Birmingham, and $47.40, delivered Chicago, and 4-in. pipe, $42. Birmingham, and $50.40 a ton, delivered Chicago.

RAILROAD MATERIALS

Rails and Track Supplies

F.o.b. Mill

Standard rails, heavier than 60 lb., per gross ton	$36.37½
Angle bars, per 100 lb.	2.55

F.o.b. Code Basing Points

Light rails (from billets) per gross ton	$35.00
Light rails (from rail steel) per gross ton	34.00

Base per 100 Lbs.

Spikes, 9/16 in. and larger	$2.40
Spikes, ½ in .and smaller	2.40
Tie plates, steel	1.90
Tie plates, Pacific Coast ports	2.00
Track bolts, to steam railroads	3.55
Track bolts, no jobbers, all sizes (per 100 count)	70 per cent off list

Basing points on light rails are Pittsburgh, Chicago and Birmingham; on spikes and tie plates, Pittsburgh, Chicago, Buffalo, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minneapolis, Colo., Birmingham and Pacific Coast ports; on tie plates alone, Steelton, Pa.; on spikes alone, Cleveland, Youngstown, Lebanon, Pa., Columbia, Pa., Richmond, Va.

BOLTS, NUTS, RIVETS AND SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

	Per Cent Off List
Machine bolts	70, 10 and 5
Carriage bolts	70, 10 and 5
Lag bolts	70, 10 and 5
Plow bolts, Nos. 1, 2, 3 and 7 heads	70, 10 and 5
Hot-pressed nuts, blank or tapped, square	70, 10 and 5
Hot-pressed nuts, blank or tapped, hexagons	70, 10 and 5
C.p.c. and t. square or hex. nuts, blank or tapped	70, 10 and 5
Semi-finished hexagon nuts, U.S.S. and S.A.E., all sizes to and incl. 1 in. diameter	70, 10 and 5
Larger than 1 in. diameter	70
Stove bolts in packages, Pittsburgh	75
Stove bolts in packages, Chicago	75
Stove bolts in packages, Cleveland	75
Stove bolts in bulk, Pittsburgh	83
Stove bolts in bulk, Chicago	83
Stove bolts in bulk, Cleveland	83
Tire bolts	60 and 5

Large Rivets

(½-in. and larger)

	Base per 100 Lb.
F.o.b. Pittsburgh or Cleveland	$2.90
F.o.b. Chicago	3.00
F.o.b. Birmingham	3.05

Small Rivets

(7/16-in. and smaller)

	Per Cent Off List
F.o.b. Pittsburgh	70 and 5
F.o.b. Cleveland	70 and 5
F.o.b. Chicago and Birm'g'm	70 and 5

Cap and Set Screws

(Freight allowed up to but not exceeding 65c. per 100 lb. on lots of 200 lb. or more)

	Per Cent Off List
Milled cap screws, 1 in. dia. and smaller	85 and 10
Milled standard set screws, case hardened, 1 in. dia. and smaller	75 and 10
Milled headless set screws, cut thread ¾ in. and smaller	75
Upset hex. head cap screws, U.S.S.S. or S.A.E. thread, 1 in. dia. and smaller	87½
Upset set screw, cut and oval point	80
Milled studs	65 to 65 and 10

Alloy and Stainless Steel

Alloy Steel Ingots

F.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem.
Uncropped .....$40 per gross ton

Alloy Steel Blooms, Billets and Slabs

F.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem.
Base price, $49 a gross ton.

Alloy Steel Bars

Price del'd Detroit is $52.
F.o.b. Pittsburgh, Chicago, Buffalo, Bethlehem, Massillon or Canton.
Open-hearth grade, base .....2.45c.
Delivered price at Detroit is .....2.60c.

S.A.E. Series Numbers	Alloy Differential per 100 lb.
2000 (½ Nickel)	$0.25
2100 (1½% Nickel)	0.55
2300 (3½% Nickel)	1.50
2500 (5% Nickel)	2.25
3100 Nickel Chromium	0.55
3200 Nickel Chromium	1.35
3300 Nickel Chromium	3.80
3400 Nickel Chromium	3.20
4100 Chromium Molybdenum (0.15 to 0.25 Molybdenum)	0.50
4100 Chromium Molybdenum (0.25 to 0.40 Molybdenum)	0.70
4600 Nickel Molybdenum (0.20 to 0.30 Molybdenum) (1.50 to 2.00 Nickel)	1.05
5100 Chromium Steel (0.60 to 0.90 Chromium)	0.35
5100 Chromium Steel (0.80 to 1.10 Chromium)	0.45
5100 Chromium Spring Steel	base
6100 Chromium Vanadium Bar	1.20
6100 Chromium Vanadium Spring Steel	0.70
Chromium Nickel Vanadium	1.50
Carbon Vanadium	0.95

These prices are for hot-rolled steel bars. The differential for most grades in electric furnace steel is 50c. higher. The differential for cold-drawn bars is ½c. per lb. higher with separate extras. Blooms, billets and slabs under 4x4 in. or equivalent are sold on the bar base. Slabs with a section area of 16 in. and 2½ in. thick or over take the billet base. Sections 4x4 in. to 10x10 in. or equivalent carry a gross ton price, which is the net price for bars for the same analysis. Larger sizes carry extras.

Alloy Cold-Finished Bars

F.o.b. Pittsburgh, Chicago, Gary, Cleveland or Buffalo. 2.95c. base per lb.

STAINLESS STEEL No. 302

(17 to 19% Cr. 7 to 9% Ni. 0.08 to 0.20% C.)

(Base Prices f.o.b. Pittsburgh)

	Per Lb.
Forging billets	19.55c.
Rerolling slabs	15c.
Bars	23c.
Plates	26c.
Structural shapes	23c.
Sheets	33c.
Hot-rolled strip	20½c.
Cold-rolled strip	27c.
Drawn wire	23c.

Raw and Semi-Finished Steel

Carbon Steel Rerolling Ingots

F.o.b. Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham.
Uncropped .....$29 per gross ton

Carbon Steel Forging Ingots

F.o.b. Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Birmingham.
Uncropped .....$31 per gross ton

Billets, Blooms and Slabs

F.o.b. Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham.

	Per Gross Ton
Rerolling	$27.00
Forging quality	32.00

Delivered Detroit

Rerolling	$30.00
Forging	35.00

Billets Only F.o.b. Duluth

Rerolling	$29.00
Forging	34.00

Sheet Bars

Fo.b. Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open-hearth or Bessemer	$28.00

Skelp

F.o.b. Pittsburgh, Chicago, Youngstown, Buffalo, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved	1.70c.
Universal	1.70c.
Sheared	1.70c.

Tube Rounds

	Base per Lb.
F.o.b. Pittsburgh	1.80c.
F.o.b. Chicago	1.85c.
F.o.b. Cleveland	1.85c.
F.o.b. Buffalo	1.90c.
F.o.b. Birmingham	1.95c.

Wire Rods

(Common, base)

	Per Gross Ton
F.o.b. Pittsburgh	$38.00
F.o.b. Cleveland	38.00
F.o.b. Chicago	39.00
F.o.b. Anderson, Ind.	39.00
F.o.b. Youngstown	39.00
F.o.b. Worcester, Mass.	40.00
F.o.b. Birmingham	41.00
F.o.b. San Francisco	47.00
F.o.b. Galveston	44.00

Pig Iron and Ferroalloys

PIG IRON

PRICES PER GROSS TON AT BASING POINTS

Basing Points	No. 2 Fdry.	Malleable	Basic	Bessemer
Everett, Mass.	$19.50	$20.00	$19.00	$20.50
Bethlehem, Pa.	19.50	20.00	19.00	20.50
Birdsboro, Pa.	19.50	20.00	19.00	20.50
Swedeland, Pa.	19.50	20.00	19.00	20.50
Steelton, Pa.	....	....	19.00	....
Sparrows Point, Md.	19.50	....	19.00	....
Neville Island, Pa.	18.50	18.50	18.00	19.00
Sharpsville, Pa.	18.50	18.50	18.00	19.00
Youngstown	18.50	18.50	18.00	19.00
Buffalo	18.50	19.00	17.50	19.50
Erie, Pa.	18.50	19.00	18.00	19.50
Cleveland	18.50	18.50	18.00	19.00
Toledo, Ohio	18.50	18.50	18.00	19.00
Jackson, Ohio	20.25	20.25	19.75	20.75
Detroit	18.50	18.50	18.00	19.00
Hamilton, Ohio	18.50	18.50	18.00	19.00
Chicago	18.50	18.50	18.00	19.00
Granite City, Ill.	18.50	18.50	18.00	....
Duluth, Minn.	19.00	19.00	....	19.50
Birmingham	14.50	14.50	13.50	19.00
Provo, Utah	17.50	....	17.00	....

DELIVERED PRICES PER GROSS TON AT CONSUMING CENTERS

	No. 2 Fdry.	Malleable	Basic	Bessemer
Boston Switching District From Everett, Mass.	$20.00	$20.50	$19.50	$21.00
Brooklyn From East. Pa.	21.9289	22.4289	21.9289	22.9289
Newark or Jersey City, N. J. From East. Pa.	20.9873	21.4873	20.4873	21.9873
Philadelphia From Eastern Pa.	20.3132	20.8132	19.8132	21.3132
Cincinnati From Hamilton, Ohio	19.5807	19.5807	19.0807	20.0807
Canton, Ohio From Cleveland and Youngstown	19.8402	19.8402	19.3402	20.3402
Columbus, Ohio From Hamilton, Ohio	20.64	20.64	....	....
Mansfield, Ohio From Cleveland and Toledo	20.3832	20.3832	....	....
Indianapolis From Hamilton, Ohio	20.9289	20.9289	....	....
South Bend, Ind. From Chicago	20.6935	20.6935	....	....
Milwaukee From Chicago	19.57	19.57	....	....
St. Paul From Duluth	20.94	....	....	....
Davenport, Iowa From Chicago	20.3832	20.3832	....	....
Kansas City From Granite City	21.2178	21.2178	....	....

Delivered prices on Southern iron for shipment to Northern points are 38c. a gross ton below delivered prices from the nearest Northern basing points.

LOW PHOSPHORUS PIG IRON

Basing points: Birdsboro, Pa., Steelton, Pa., and Standish, N. Y.....$23.50

GRAY FORGE PIG IRON

Valley furnace	$18.00
Pittsburgh district furnace	18.00

CHARCOAL PIG IRON

Lake Superior furnace	$21.00
Delivered Chicago	24.2528
Delivered Buffalo	24.57

CANADA

Pig Iron

Per gross ton:

Delivered Toronto

No. 1 fdy., sil. 2.25 to 2.75	$21.00
No. 2 fdy., sil. 1.75 to 2.75	20.50
Malleable	21.00

Delivered Montreal

No. 1 fdy., sil. 2.25 to 2.75	$22.50
No. 2 fdy., sil. 1.75 to 2.25	22.00
Malleable	22.50
Basic	22.00

FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans.

	Per Gross Ton
Domestic, 80% (carload)	$85.00

Spiegeleisen

	Per Gross Ton Furnace
Domestic, 19 to 21%	$26.00
50-ton lots 3-mo. shipment	24.00
F.o.b. New Orleans	26.00

Electric Ferrosilicon

	Per Gross Ton Delivered
50% (carloads)	$77.50
50% (ton lots)	85.00
75% (carloads)	126.00
75% (ton lots)	136.00

Silvery Iron

F.o.b. Jackson, Ohio, Furnace

Per Gross Ton		*Per Gross Ton*	
6%	$22.75	12%	$29.25
7%	23.75	13%	30.75
8%	24.75	14%	32.25
9%	25.75	15%	33.75
10%	26.75	16%	35.25
11%	27.75	17%	36.75

The lower all-rail delivered price from Jackson or Buffalo is quoted with freight allowed. Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Bessemer Ferrosilicon

F.o.b. Jackson, Ohio, Furnace

Per Gross Ton		*Per Gross Ton*	
10%	$27.75	14%	$33.25
11%	28.75	15%	34.75
12%	30.25	16%	36.25
13%	31.75	17%	37.75

Manganese 1½ to 3%, $1 a ton additional. For each unit of manganese over 3%, $1 a ton additional. Phosphorus 0.75% or over, $1 ton additional.

Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Other Ferroalloys

Ferrotungsten, per lb. contained W. del., carloads	$1.35 to $1.45
Ferrotungsten, less carloads	1.45 to 1.55
Ferrochromium, 4 to 6% carbon and up, 65 to 70% Cr. per lb. contained Cr. delivered, in carloads	10.00c.
Ferrochromium, 2% carbon	16.50c. to 17.00c.
Ferrochromium, 1% carbon	17.50c. to 18.00c.
Ferrochromium, 0.10% carbon	19.50c. to 20.00c.
Ferrochromium, 0.06% carbon	20.00c. to 20.50c.
Ferrovanadium, del. per lb. contained V.	$2.70 to $2.90
Ferrocarbontitanium, 15 to 18% Ti, 6 to 8% C, f.o.b. furnace carload and contract per net ton	$137.50
Ferrophosphorus, electric, or blast furnace material, in carloads, 18%, Rockdale, Tenn., base, per gross ton with $2 unitage	58.00
Ferrophosphorus, electric, 24% f.o.b. Anniston, Ala., per gross ton with $2.75 unitage	65.00
Ferromolybdenum, per lb. Mo., del. 95c.	
Calcium molybdate, per lb. Mo., del.	80c.
Silico spiegel, per ton, f.o.b. furnace, car lots	$38.00
Ton lots or less per ton	45.50
Silico-manganese, gross ton, delivered:	
2.50% carbon grade	90.00
2% carbon grade	95.00
1% carbon grade	105.00
Spot prices	$5 a ton higher

Iron and Steel Scrap

PITTSBURGH

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$11.50 to $12.00
No. 2 heavy melting steel	10.00 to 10.50
No. 2 railroad wrought	11.50 to 12.00
Scrap rails	13.00 to 13.50
Rails, 3 ft. and under	13.50 to 14.00
Compressed sheet steel	11.25 to 11.75
Hand bundled sheet steel	10.00 to 10.50
Hvy. steel axle turnings	10.00 to 10.50
Machine shop turnings	8.00 to 8.50
Short shov. turnings	8.00 to 8.50
Short mixed borings and turnings	6.25 to 6.75
Cast iron borings	6.25 to 6.75
Cast iron carwheels	12.00 to 12.50
Heavy breakable cast	11.50 to 12.00
No. 1 cast	13.00 to 13.50
Railr. knuckles and couplers	14.25 to 14.75
Rail, coil and leaf springs	14.25 to 14.75
Rolled steel wheels	14.25 to 14.75
Low phos. billet crops	15.00 to 15.50
Low phos. sheet bar crops	14.25 to 14.75
Low phos. plate scrap	14.00 to 14.50
Low phos. punchings	14.00 to 14.50
Steel car axles	14.25 to 14.75

CHICAGO

Delivered Chicago district consumers:

	Per Gross Ton
Heavy melting steel	$9.75 to $10.00
Automobile hvy. melt. steel	9.00 to 9.50
Shoveling steel	9.75 to 10.00
Hydraulic comp. sheets	8.50 to 9.00
Drop forge flashings	7.50 to 8.00
No. 1 busheling	8.00 to 8.50
Rolled carwheels	11.00 to 11.50
Railroad tires	11.50 to 12.00
Railroad leaf springs	10.50 to 11.00
Axle turnings	8.75 to 9.25
Steel couplers and knuckles	10.75 to 11.25
Coil springs	11.75 to 12.25
Axle turnings (elec. fur.)	9.25 to 9.75
Low phos. punchings	13.00 to 13.50
Low phos. plates, 12 in. and under	13.00 to 13.50
Cast iron borings	5.00 to 5.50
Short shoveling turnings	5.00 to 5.50
Machine shop turnings	4.75 to 5.25
Rerolling rails	10.50 to 11.00
Steel rails, less than 3 ft.	11.50 to 12.00
Steel rails, less than 2 ft.	12.50 to 13.00
Angle bars, steel	12.00 to 12.50
Cast iron carwheels	10.50 to 11.00
Railroad malleable	12.00 to 12.50
Agricultural malleable	9.50 to 10.00

	Per Net Ton
Iron car axles	$13.50 to $14.00
Steel car axles	13.00 to 13.50
No. 1 railroad wrought	7.75 to 8.25
No. 2 railroad wrought	8.25 to 8.75
No. 2 busheling	4.50 to 5.00
Locomotive tires, smooth	10.00 to 10.50
Pipe and flues	5.00 to 5.50
No. 1 machinery cast	9.00 to 9.50
Clean automobile cast	8.50 to 9.00
No. 1 railroad cast	8.00 to 8.50
No. 1 agricultural cast	8.00 to 8.50
Stove plate	6.00 to 6.50
Grate bars	5.50 to 6.00
Brake shoes	6.00 to 6.50

PHILADELPHIA

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	*$9.50 to $10.50
No. 2 heavy melting steel	*8.50 to 9.50
No. 1 railroad wrought	10.00 to 10.50
Bundled sheets	9.50 to 10.00
Hydraulic compressed, new	9.50 to 10.00
Hydraulic compressed, old	7.00 to 7.50
Machine shop turnings	6.00 to 6.50
Heavy axle turnings	8.50 to 9.00
Cast borings	5.00 to 5.50
Stove plate (steel works)	8.00 to 8.50
Heavy breakable cast	10.50 to 11.00
No. 1 low phos. heavy	13.75 to 14.25
Couplers and knuckles	13.50 to 14.00
Rolled steel wheels	13.50 to 14.00
No. 1 blast furnace	4.75 to 5.00
Spec. iron and steel pipe	8.50 to 9.00
Shafting	17.00 to 17.50
Steel axles	16.00
No. 1 forge fire	9.50 to 10.00
Cast iron carwheels	11.00 to 11.50
No. 1 cast	11.00 to 11.50
Cast borings (chem.)	10.50 to 13.00
Steel rails for rolling	12.00 to 12.50

* Brokers' buying price for export.

CINCINNATI

Dealers' buying prices per gross ton:

No. 1 heavy melting steel	$7.75 to $8.25
No. 2 heavy melting steel	6.25 to 6.75
Scrap rails for melting	7.75 to 8.25
Loose sheet clippings	4.25 to 4.75
Bundled sheets	5.75 to 6.25
Cast iron borings	4.25 to 4.75
Machine shop turnings	4.25 to 4.75
No. 1 busheling	5.75 to 6.25
No. 2 busheling	2.50 to 3.00
Rails for rolling	8.73 to 9.25
No. 1 locomotive tires	7.00 to 7.50
Short rails	11.25 to 11.75
Cast iron carwheels	7.75 to 8.25
No. 1 machinery cast	9.00 to 9.50
No. 1 railroad cast	8.25 to 8.75
Burnt cast	5.75 to 6.25
Stove plate	5.75 to 6.25
Agricultural malleable	7.75 to 8.25
Railroad malleable	8.75 to 9.25

CLEVELAND

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$9.50 to $10.00
No. 2 heavy melting steel	9.00 to 9.50
Compressed sheet steel	9.00 to 9.50
Light bundled sheet stampings	7.50 to 8.00
Drop forge flashings	8.50 to 9.00
Machine shop turnings	6.25 to 6.75
Short shoveling turnings	6.50 to 7.00
No. 1 busheling	8.50 to 9.00
Steel axle turnings	9.00 to 9.50
Low phos. billet crops	14.00 to 14.50
Cast iron borings	6.50 to 7.00
Mixed borings and short turnings	6.50 to 7.00
No. 2 busheling	6.50 to 7.00
No. 1 cast	11.00 to 11.50
Railroad grate bars	7.00 to 7.50
Stove plate	7.50 to 8.00
Rails under 3 ft.	13.50 to 14.00
Rails for rolling	15.50 to 18.00
Railroad malleable	12.50 to 13.00
Cast iron carwheels	10.75 to 11.00

BUFFALO

Per gross ton, f.o.b. Buffalo consumers' plants:

No. 1 heavy melting steel	$11.00
No. 2 heavy melting scrap	10.00
Scrap rails	11.00
New hydraul. comp. sheets	10.00
Old hydraul. comp. sheets	9.00
Drop forge flashings	10.00
No. 1 busheling	10.00
Hvy. steel axle turnings	$8.00 to 8.50
Machine shop turnings	4.50 to 5.00
Knuckles and couplers	11.50 to 12.00
Coil and leaf springs	11.50 to 12.00
Rolled steel wheels	11.50 to 12.00
Low phos. billet crops	12.00 to 12.50
Short shov. steel turnings	6.00 to 6.50
Short mixed borings and turnings	6.00 to 6.50
Cast iron borings	6.00 to 6.50
No. 2 busheling	6.50
Steel car axles	11.50 to 12.00
Iron axles	11.50 to 12.00
No. 1 machinery cast	11.50 to 12.50
No. 1 cupola cast	10.50 to 11.00
Stove plate	9.00 to 9.50
Steel rails, 3 ft. and under	12.50 to 13.00
Cast iron carwheels	11.00 to 11.50
Industrial malleable	12.00 to 13.00
Railroad malleable	12.00 to 13.00
Chemical borings	8.00 to 8.50

BOSTON

Dealers' buying prices per gross ton:

*No. 1 heavy melting steel	$8.50 to $8.75
No. 1 heavy melting steel	6.15 to 6.65
*Scrap T rails	8.50 to 9.00
Scrap rails	6.40 to 6.65
*No. 2 steel	7.50 to 7.75
No. 2 steel	5.15 to 5.65
Breakable cast	5.25 to 5.50
Machine shop turnings	2.40 to 2.50
*Machine shop turnings (short)	4.50
Bundled skeleton, long	4.50 to 5.00
Forge flashings	5.00 to 5.50
Shafting	11.75 to 12.00
Steel car axles	11.50 to 12.00
Cast iron borings, chemical	6.50 to 7.00
*Stove plate	6.25 to 6.50

Per gross ton delivered consumers' yards:

Textile cast	$9.00 to $9.50
No. 1 machinery cast	9.00 to 9.50
Stove plate	6.00 to 6.50
Railroad malleable	11.00 to 11.50

* Delivered local army base.

NEW YORK

Dealers' buying prices per gross ton:

No. 1 heavy melting steel	*$7.00 to †$8.50
No. 2 heavy melting steel	*5.50 to †7.50
Heavy breakable cast	6.25 to 6.75
No. 1 machinery cast	7.00 to 7.50
No. 2 cast	†6.25
Stove plate	†6.25
Steel car axles	13.50 to 14.00
No. 1 railroad wrought	7.00 to 7.50
No. 1 yard wrought, long	6.00 to 6.50
Spec. iron and steel pipe	4.50 to 5.00
Forge fire	5.50 to 6.00
Rails for rolling	8.50 to 9.00
Short shoveling turnings	2.00 to 2.50
Machine shop turnings	2.00 to 2.50
Cast borings	3.50 to 3.75
No. 1 blast furnace	2.00 to 2.50
Cast borings (chemical)	11.00 to 11.50
Unprepared yard iron and steel	4.00 to 4.50

Per gross ton, delivered local foundries:

No. 1 machinery cast	$10.00
No. 1 hvy. cast (cupola size)	9.00
No. 2 cast	7.50

* For direct car loading only.
† Loading on barge.

BIRMINGHAM

Per gross ton delivered consumers' yards:

Heavy melting steel	$9.00 to $9.50
Scrap steel rails	10.00 to 10.50
Short shoveling turnings	7.00
Stove plates	7.00
Steel axles	11.50
Iron axles	11.50
No. 1 railroad wrought	7.00
Rails for rolling	12.50
No. 1 cast	9.50 to 10.00
Tramcar wheels	10.00

ST. LOUIS

Per gross ton delivered consumers' yards:

Selected heavy steel	$8.75 to $9.25
No. 1 heavy melting	8.25 to 8.75
No. 2 heavy melting	7.50 to 8.00
No. 1 locomotive tires	9.75 to 10.25
Misc. stand-sec. rails	9.75 to 10.25
Railroad springs	11.00 to 11.50
Bundled sheets	6.00 to 6.50
No. 2 railroad wrought	8.25 to 8.75
No. 1 busheling	5.00 to 5.50
Cast iron borings and shoveling turnings	3.00 to 3.50
Rails for rolling	10.00 to 10.50
Machine shop turnings	2.75 to 3.25
Heavy turnings	5.50 to 6.00
Steel car axles	12.50 to 13.00
Iron car axles	15.00 to 16.00
No. 1 railroad wrought	6.00 to 6.50
Steel rails less than 3 ft.	11.50 to 12.00
Steel angle bars	9.50 to 10.00
Cast iron carwheels	8.00 to 8.50
No. 1 machinery cast	8.50 to 9.00
Railroad malleable	10.50 to 11.00
No. 1 railroad cast	8.00 to 8.50
Stove plate	6.50 to 7.00
Agricult. malleable	8.50 to 9.00

DETROIT

Dealers' buying prices per gross ton:

Heavy melting steel	$7.50 to $8.00
Borings and short turnings	4.25 to 4.75
Long turnings	$3.75 to $4.25
No. 1 machinery cast	11.00 to 11.50
Automotive cast	11.25 to 11.75
Hydraul. comp. sheets	8.00 to 8.50
Stove plate	6.50 to 7.00
New factory busheling	6.50 to 7.00
Old No. 2 busheling	3.75 to 4.25
Sheet clippings	4.75 to 5.25
Flashings	7.00 to 7.50
Low phos. plate scrap	7.50 to 8.00

CANADA

Dealers' buying prices per gross ton:

	Toronto	Montreal
Heavy melting steel	$7.00	$7.00
Rails scrap	8.00	8.00
Machine shop turnings	3.00	3.00
Boiler plate	4.50	4.50
Heavy axle turnings	4.50	4.00
Cast borings	4.00	3.50
Steel borings	2.00	2.00
Wrought pipe	3.50	3.50
Steel axles	7.00	8.00
Axles, wrought iron	7.00	8.00
No. 1 machinery cast	9.00	9.00
Stove plate	5.50	5.00
Standard carwheels	7.25	7.00
Malleable	6.75	7.00

ORES, FLUORSPAR, COKE, FUEL, REFRACTORIES

Lake Superior Ores

Delivered Lower Lake Ports

	Per Gross Ton
Old range, Bessemer, 51.50% iron	$4.80
Old range, non-Bessemer, 51.50% iron	4.65
Mesabi, Bessemer, 51.50% iron	4.65
Mesabi, non-Bessemer, 51.50% iron	4.50
High phosphorus, 51.50% iron	4.40

Foreign Ore

C.i.f. Philadelphia or Baltimore

	Per Unit
Iron, low phos., copper free, 55 to 58% iron, dry Spanish or Algeria	9.50c.
Iron, low phos., Swedish, average 68½% iron	9.50c.
Iron, basic or foundry, Swedish, aver. 65% iron	9c.
Iron, basic or foundry, Russian, aver. 65% iron	9c.
Manganese, Caucasian, washed 52%	26c.
Manganese, African, Indian, 44-48%	21c.
Manganese, African, Indian, 49-51%	24c.
Manganese, Brazilian, 46 to 48½%	20c.

	Per Net Ton Unit
Tungsten, Chinese, wolframite, duty paid, delivered*	$17.50 to $18.50
Tungsten, domestic, scheelite, delivered†	17.00

	Per Gross Ton
Chrome, 45%, Cr_2O_3, crude, c.i.f. Atlantic Seaboard	$17.00
Chrome, 48%, Cr_2O_3, c.i.f. Atlantic Seaboard	20.00

* Quotations nominal in absence of sales.
† Nominal; no supplies available.

Fluorspar

	Per Net Ton
Domestic, washed gravel, 85-5, f.o.b. Kentucky and Illinois mines for all-rail shipment	$13.00
Same grade for Ohio River barge shipment for Kentucky and Illinois River landings	16.00
No. 2 lump, 85-5, f.o.b. Kentucky and Illinois mines	14.00
Foreign, 85% calcium fluoride, not over 5% silicon, c.i.f. Atlantic ports, duty paid	19.00
Domestic, No. 1 ground bulk, 95 to 98% calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines	30.00

COKE, COAL AND FUEL OIL

Coke

	Per Net Ton
Furnace, f.o.b. Connellsville Prompt	$3.50 to $3.75
Foundry, f.o.b. Connellsville Prompt	4.00 to 5.10
Foundry, by-product, Chicago ovens, for delivery outside switching district	8.50
Foundry, by-product, delivered in Chicago switching district	9.25
Foundry, by-product, New England, delivered	11.00
Foundry, by-product, Newark or Jersey City, cel'd	9.24 to 9.72
Foundry, by-product, Phila.	9.03
Foundry, by-product, Cleveland, delivered	$9.25
Foundry, Birmingham	6.00
Foundry, by-product, St. Louis, f.o.b. ovens	8.00
Foundry, by-product, del'd St. Louis	9.00

Coal

	Per Net Ton
Mine run steam coal, f.o.b. W. Pa. mines	$1.60 to $1.80
Mine run coking coal, f.o.b. W. Pa.	1.80 to 2.10
Gas coal, ¾-in., f.o.b. Pa. mines	2.00 to 2.50
Mine run gas coal, f.o.b. Pa. mines	1.90 to 2.10
Steam slack, f.o.b. W. Pa. mines	1.25 to 1.50
Gas slack, f.o.b. W. Pa. mines	1.35 to 1.60

Fuel Oil

	Per Gal. f.o.b. Bayonne, N. J.
No. 3 distillate	4.00c.
No. 4 industrial	3.50c.

	Per Gal. f.o.b. Baltimore
No. 3 distillate	4.00c.
No. 4 industrial	3.50c.

	Per Gal. del'd Chicago
No. 3 industrial fuel oil	3.88c.
No. 5 industrial fuel oil	3.38c.

	Per Gal. f.o.b. Cleveland
No. 3 distillate	5.50c.
No. 4 industrial	5.25c.
No. 5 industrial	4.25c.

REFRACTORIES

Fire Clay Brick

	Per 1000 f.o.b. Works High-heat Duty Brick	Intermediate Duty Brick
Pennsylvania	$45.00	$40.00
Maryland	45.00	40.00
New Jersey	55.00	43.00
Ohio	45.00	40.00
Kentucky	45.00	40.00
Missouri	45.00	40.00
Illinois	45.00	40.00
Ground fire clay, per ton	7.00	

Silica Brick

	Per 1000 f.o.b. Works
Pennsylvania	$45.00
Chicago District	54.00
Birmingham	55.00
Silica clay, per net ton	8.00

Chrome Brick

	Per Net Ton
Standard, f.o.b. Baltimore, Plymouth Meeting and Chester, Pa.	$45.00
Chemically Bonded f.o.b. Baltimore, Plymouth Meeting and Chester, Pa.	42.50

Magnesite Brick

	Per Net Ton
Standard, f.o.b. Baltimore and Chester, Pa.	$65.00
Chemically Bonded, f.o.b. Baltimore	55.00

Grain Magnesite

	Per Net Ton
Imported, f.o.b. Baltimore and Chester, Pa.	$45.00
Domestic, f.o.b. Baltimore and Chester	40.00
Domestic, f.o.b. Chewelah, Wash.	22.00

Warehouse Prices for Steel Products

PITTSBURGH

	Base per Lb.
Plates	3.15c.
Structural shapes	3.15c.
Soft steel bars and small shapes	2.90c.
Reinforcing steel bars	2.90c.
Cold-finished and screw stock:	
Rounds and hexagons	3.20c.
Squares and flats	3.20c.
Hoops and bands under ¼ in.	3.20c.
Hot-rolled annealed sheets (No. 24), 25 or more bundles	3.30c.
Galv. sheets (No. 24), 25 or more bundles	3.95c.
Hot-rolled sheets (No. 10)	2.95c.
Galv. corrug. sheets (No. 28), per square (more than 3750 lb.)	$3.69
Spikes, large	2.90c.
Track bolts, all sizes, per 100 count,	65 per cent off list.
Machine bolts, 100 counts,	65 per cent off list.
Carriage bolts, 100 count,	65 per cent off list.
Nuts, all styles, 100 count,	65 per cent off list.
Large rivets, base per 100 lb.	$3.50
Wire, black, soft ann'l'd, base per 100 lb.	*2.70
Wire, galv. soft, base per 100 lb.	*2.925
Common wire nails, per keg	*2.834
Cement coated nails, per keg	*2.834

On plates, structurals, bars, reinforcing bars, bands, hoops and blue annealed sheets, base applies to orders of 400 to 9999 lb.

*Delivered in Pittsburgh switching district.

CHICAGO

	Base per Lb.
Plates and structural shapes	3.20c.
Soft steel bars	2.95c.
Cold-fin. steel bars:	
Rounds and hexagons	3.35c.
Flats and squares	3.35c.
Hot-rolled strip	3.30c.
Hot-rolled annealed sheets (No. 24)	3.35c.
Galv. sheets (No. 24)	4.55c.
Hot-rolled sheets (No. 10)	3.05c.
Spikes (keg lots)	3.50c.
Track bolts (keg lots)	4.65c.
Rivets, structural (keg lots)	3.65c.
Rivets, boiler (keg lots)	3.75c.
	Per Cent Off List
Machine bolts	*70
Carriage bolts	*70
Lag screws	*70
Hot-pressed nuts, sq. tap. or Hot-pressed nuts, sq. tap or blank	*70
Hot-pressed nuts, hex. tap or Hot-pressed nuts, hex. tap or blank	*70
Hex. head cap screws	80
Cut point set screws	70 and 10
Flat head bright wood screws	37½ and 10
Spring cotters	50
Stove bolts in full packages	70
Rd. hd. tank rivets, 7/16 in. and smaller	57½
Wrought washers	$4.50 off list
Black ann'l'd wire per 100 lb.	$3.85
Com. wire nails, base per keg	2.95†
Cement c't'd nails, base per keg	2.95†

On plates, shapes, bars, hot-rolled strip and heavy hot-rolled sheets, the base applies on orders of 400 to 9999 lb. All prices are f.o.b. consumers' plants within the Chicago switching district.

*These are quotations delivered to city trade for quantities of 100 lb. or more. For lots of less than 100 lb., the quotation is 65 per cent off. Discounts applying to country trade are 70 per cent off, f.o.b., Chicago, with full or partial freight allowed up to 50c. per 100 lb.

†Prices for city and suburbs only.

NEW YORK

	Base per Lb.
Plates, ¼ in. and heavier	3.40c.
Structural shapes	3.37c.
Soft steel bars, small shapes	3.26c.
Iron bars	3.26c.
Iron bars, swed. charcoal	6.50c.
Cold-fin. shafting and screw stock:	
Rounds and hexagons	3.81c.
Flats and squares	4.31c.
Cold-rolled; strip, soft and quarter hard	3.36c.
Hoops	3.56c.
Bands	3.56c.
Hot-rolled sheet (No. 10)	3.31c.
Hot-rolled ann'l'd sheets (No. 24*)	3.89c.
Galvanized sheets (No. 24*)	4.50c.
Long terne sheets (No. 24)	5.20c.
Standard tool steel	11.00c.
Wire, black annealed (No. 10)	3.40c.
Wire, galv. (No. 10)	3.75c.
Tire steel, 1 x ½ in. and larger	3.65c.
Open hearth spring steel	4.00c. to 10.00c.
Common wire nails, base, per keg	$3.21
	Per Cent Off List
Machine bolts, cut thread: All diameters	65 and 10
Carriage bolts, cut thread: All diameters	65 and 10
	Per 100 Ft.
Boiler tubes: Lap welded, 2-in.	$18.05
Seamless welded, 2-in.	19.24
Charcoal iron, 2-in.	24.94
Charcoal iron, 4-in.	63.65

*No. 28 and lighter, 36 in. wide, 20c. higher per 100 lb.

ST. LOUIS

	Base per Lb.
Plates and struc. shapes	3.45c.
Bars, soft steel or iron	3.20c.
Cold-fin. rounds, shafting, screw stocks	3.75c.
Hot-rolled annealed sheets (No. 24)	4.10c.
Galv. sheets (No. 24)	4.65c.
Hot-rolled sheets (No. 10)	3.30c.
Black corrug. sheets (No. 24)	4.10c.
*Galv. corrug. sheets	4.65c.
Structural rivets	4.00c.
Boiler rivets	4.10c.
	Per Cent Off List
Tank rivets, 7/16 in. and smaller	55
Machine and carriage bolts, lag screws fittings up bolts, bolt ends, plow bolts, hot-pressed nuts, square and hexagon, tapped or blank, semi-finished nuts: All quantities	70

*No. 26 end lighter take special prices.

PHILADELPHIA

	Base per Lb.
*Plates, ¼-in. and heavier	2.98c.
*Structural shapes	2.98c.
*Soft steel bars, small shapes, iron bars (except bands)	2.93c.
‡Reinforc. steel bars, sq. twisted and deformed	2.96c.
Cold-finished steel bars	3.61c.
*Steel hoops	3.43c.
*Steel bands, No. 12 and 3/16 in., incl.	3.18c.
Spring steel	5.00c.
†Hot-rolled anneal. sheets (No. 24)	3.65c.
†Galvanized sheets (No. 24)	4.30c.
*Hot-rolled annealed sheets (No. 10	3.08c.
Diam. pat. floor plates, ¼ in.	4.95c.
Swedish iron bars	6.25c.

These prices are subject to quantity differentials except on reinforcing and Swedish iron bars.

*Base prices subject to deduction on orders aggregating 4000 lb. or over.

†For 50 bundles or over.

‡For less than 2000 lb.

CLEVELAND

	Base per Lb.
Plates and struc. shapes	3.31c.
Soft steel bars	2.95c.
Reinforc. steel bars	2.10c.
Cold-finished steel bars	3.25c.
Flat-rolled steel under ⅛ in.	3.36c.
Cold-finished strip	†3.00c.
Hot-rolled annealed sheets (No. 24)	3.96c.
Galvanized sheets (No. 24)	4.61c.
Hot-rolled sheets (No. 10)	3.11c.
Hot-rolled 3/16 in. 24 to 48 in. wide sheets	3.56c.
Black ann'l'd wire, per 100 lb.	$2.65
No. 9 galv. wire, per 100 lb.	3.00
Com. wire nails, base per keg	2.40

†Outside delivery 10c. less.

CINCINNATI

	Base per Lb.
Plates and struc. shapes	3.42c.
Bars, soft steel or iron	3.17c.
New billet reinforc. bars	3.25c.
Rail steel reinforc. bars	3.25c.
Hoops and bands, 3/16 in. and lighter	3.47c.
Cold-finished bars	3.57c.
Hot-rolled annealed sheets (No. 24)	4.02c.
Galv. sheets (No. 24)	4.72c.
Hot-rolled sheets (No. 10)	3.22c.
Structural rivets	4.35c.
Small rivets	55 per cent off list
No. 9 ann'l'd wire, per 100 lb. (1000 lb. or over)	$2.88
Com. wire nails, base per keg: Any quantity less than carload	3.04
Cement c't'd nails, base 100-lb. keg	3.50
Chain, 1-in., per 100 lb.	8.35
	Net per 100 Ft.
Seamless steel boiler tubes, 2-in.	$21.67
4-in.	51.19
Lap-welded steel boiler tubes, 2-in.	20.62
4-in.	48.19

BUFFALO

	Base per Lb.
Plates	3.38c.
Struc. shapes	3.25c.
Soft. steel bars	3.00c.
Reinforcing bars	2.60c.
Cold-fin. flats and sq.	3.40c.
Round and hex.	3.40c.
Cold-rolled strip steel	3.19c.
Hot-rolled annealed sheets (No. 24)	4.06c.
Heavy hot-rolled sheets, 3/16 in., 24 to 48 in. wide	3.63c.
Galv. sheets (No. 24)	4.70c.
Bands	3.43c.
Hoops	3.43c.
Heavy hot-rolled sheets	3.18c.
Com. wire nails, base per keg	$3.33
Black wire, base per 100 lb. (2500-lb. lots or under)	3.55
(Over 2500 lb.)	3.45

BOSTON

	Base per Lb.
Reams, channels, angles, tees, zees	3.54c.
H beams and shapes	3.54c.
Plates—sheered, tank and univ. mill, ¼ in. thick and heavier	3.56c.
Floor plates, diamond pattern	5.36c.
Bar and bar shapes (mild steel)	3.35c.
Bands 3/16 in. thick and No. 12 ga. incl.	3.65c. to 4.65c.
Half rounds, half ovals, ovals and bevels	4.60c.
Tire steel	4.60c.
Cold-rolled strip steel	3.245c.
Cold-finished rounds, squares and hexagons	3.90c.
Cold-finished flats	3.75c.
Blue annealed sheets, No. 10 ga.	3.65c.
One pass cold-rolled sheets No. 24 ga.	4.20c.
Galvanized steel sheets, No. 24 ga.	4.90c.
Lead coated sheets, No. 24 ga.	5.85c.

Prices delivered by truck in metropolitan Boston, subject to quantity differentials.

DETROIT

	Base per Lb.
Soft steel bars	3.04c.
Structural shapes	3.42c.
Plates	3.42c.
Floor plates	5.17c.
Hot-rolled annealed sheets (No. 24)	3.94c.
Hot-rolled sheets (No. 10)	3.14c.
Galvanized sheets (No. 24)	4.72c.
Bands	3.39c.
Hoops	3.39c.
Cold-finished bars	3.49c.
Cold-rolled strip	3.13c.
Hot-rolled alloy steel (S.A.E. 3100 Series)	5.29c.*
Bolts and nuts	..70 and 5 per cent off list

Prices delivered by truck in metropolitan Detroit, subject to quantity differentials.

* Price applies to 1,000 lb. and over.

MILWAUKEE

	Base per Lb.
Plates and structural shapes	3.31c.
Soft steel bars	3.06c.
Hot-rolled strip	3.41c.
Hot-rolled sheets (No. 10)	3.16c.
Hot-rolled annealed sheets (No. 24)	3.96c.
Galvanized sheets (No. 24)	4.66c.
Cold-finished steel bars	3.61c.
Cold-rolled strip	3.30c.
Structural rivets (keg lots)	3.86c.
Boiler rivets (keg lots)	3.96c.
Track spikes (keg lots)	3.71c.
Track bolts (keg lots)	4.86c.
Black annealed wire	3.10c.
Com. wire nails	2.90c.
Cement coated nails	2.90c.
	Per Cent Off List
Machine bolts	70
Carriage bolts	70
Hot-pressed nuts, sq. and hex., tapped or blank (keg lots)	70

Prices given above are delivered Milwaukee.

On plates, shapes, bars, hot-rolled strip and heavy hot-rolled sheets, the base applies on orders of 400 to 9999 lb. On galvanized and No. 24 hot-rolled annealed sheets the prices given apply on order of 400 to 3499 lb. On cold-finished bars the prices are for orders of 300 to 499 lb.

ST. PAUL

	Base per Lb.
Mild steel bars	3.20c.
Structural shapes	3.45c.
Plates	3.45c.
Cold-finished bars	3.87c.
Bands and hoops	3.55c.
Hot-rolled annealed sheets, No. 24	3.90c.
Galvanized sheets, No. 24	4.50c.
Cold-rolled sheets, No. 20	4.95c.

On mild steel bars, shapes, plates and hoops and bands the base applies on 400 to 14,999 lb. On cold-finished bars, hot-rolled sheets, galvanized sheets and cold-rolled sheets base applies on 15,000 lb. and over.

PACIFIC COAST

	Base per Lb. San Francisco	Los Angeles	Seattle
Plates, tank and U. M.	3.55c.	3.60c.	3.55c.
Shapes, standard	3.55c.	3.60c.	3.55c.
Soft steel bars	3.60c.	3.60c.	3.60c.
Reinforcing bars, f.o.b. cars dock Pacific ports	2.45c.	2.45c.	2.45c.
Hot-rolled annealed sheets (No. 24)	4.40c.	4.35c.	4.40c.
Hot-rolled sheets (No. 10)	3.75c.	3.70c.	3.75c.
Galv. sheets (No. 24)	5.00c.	4.95c.	5.00c.
Cold finished steel: Rounds	5.95c.	5.85c.	6.00c.
Squares and hexagons	7.20c.	7.10c.	7.25c.
Flats	7.70c.	7.60c.	8.25c.
Common wire nails —base per keg less carload	$3.30	$3.40	$3.30

All items subject to differentials for quantity.

TOOL STEEL

Prices are same for warehouse distribution at all points on or East of Mississippi River. West of Mississippi quotations are 1c. a lb. higher.

	Base per Lb.
High speed	57c.
High carbon chrome	37c.
Oil hardening	22c.
Extra	17c.
Regular	14c.

Weekly Indications of Steel Activity

From THE IRON AGE

	June 25, 1935	June 18, 1935	May 28, 1935	June 26, 1934	Average, Year to Date 1935	1934
Steel ingot operations—Per cent of capacity	38.0	38.0	42.5	48.0	46.4	48.4

	Week Ended June 25, 1935	June 18, 1935	May 28, 1935	June 26, 1934	Year to Date 1935	1934
Fabricated structural steel awards	....	27,000	6,250	8,750	354,552	426,370
Fabricated plate awards	....	1,620	2,175	765	55,697	74,597
Sheet steel piling awards	....	1,220	2,150	0	23,365	23,240
Reinforcing bar awards	....	3,000	5,040	3,200	108,355	108,735

Copper Prices to Be Tested This Week On Large Purchase by Government

Tin Strengthens Slightly on Better Demand—Lead Unaffected by Report of Stock Increase—Zinc Firm

NEW YORK, June 25.—The copper market remains in the doldrums because of price uncertainty, but the situation is expected to be clarified tomorrow when bids are opened by the Government at Washington on 500 tons of copper. Primary producers have been adhering rigidly to 9c. a lb., delivered Connecticut Valley, on such sales as have been made, but transactions have been averaging well under 500 tons daily since the collapse of the NRA and the copper code. Some secondary metal has been available at as low as 8c. a lb., but the supply seems to be limited. The London price rose to 7.50c. a lb., usual Continental base ports, yesterday, and buying was reported to be brisk. Today, however, dullness again has prevailed, and electrolytic copper was quotable at around 7.40c. a lb. at London.

Tin

This market has been slightly more active in the last week with some of the tin plate makers showing a little interest in August, September and October tin. Buying has not been heavy, but prices have strengthened slightly to 51.25c. a lb., New York, on spot metal. The market has not fallen under 51c. all week, and the firmer undertone is partially attributable to the disappearance of most of the resale metal which has been hanging over the market. At London this morning standard tin was quotable at £229 15s. for spot and £219 15s. for futures, while Straits metal was holding at £238 15s. The market in the East was £228 2s. 5d.

Lead

Publication yesterday of May statistics, which revealed an increase in refined stocks of 5000 tons during the month, had no visible influence on the market. Both buyers and sellers had foreseen some increase after the sharp decline during April, and this may have been reflected in the recent price reaction. It has been pointed out that so long as there is no marked change in total stocks, the position of the market is not materially weakened despite fluctuations in refined metal available. May production amounted to 37,358 net tons, and shipments to 32,341 tons; while refined stocks at the end of the month stood at 225,057 tons, compared with 220,053 tons at the end of April. Prices are unchanged at 3.85c. a lb., St. Louis, and 4c., New York, while the leading interest continues to book a fair amount of business at a $2-a-ton premium. The ore market is quotable at $38 to $40 a ton.

Zinc

Zinc continues rather quiet, although prices are very well maintained at 4.30c. a lb., East St. Louis, and 4.67½c., New York. Sales last week of 1450 tons were more than double the previous week's total, but fell considerably under the May average. Undelivered sales also declined another 2000 tons. The Joplin ore market is unchanged at $27 a ton for flotation and $28 for mill grades. Production last week totaled 6500 tons, compared with sales of 6200 tons and shipments of 8600 tons.

Ingot Brass and Bronze

The Non-Ferrous Ingot Metal Institute reports that in the 28-day period ended June 14, the average prices paid for commercial 80-10-10 and commercial 85-5-5-5 brass ingots were 9.370c. a lb. and 7.799c. a lb. respectively, compared with 9.344c. and 7.796c. a lb. respectively in the preceding 28-day period. Combined deliveries of brass and bronze ingots and billets by members of the institute amounted to 4620 tons in May, against 5698 tons in April.

Chromite is the subject of an article by G. H. Chambers, secretary of Foote Mineral Co., Inc., Philadelphia, in the semi-annual number of Foote Prints, published by the company. Titanium Minerals in Welding Rod Coatings, by L. G. Bliss of the Foote company, is also included. Analyses and specifications of Foote products are given in a separate section.

The Week's Prices. Cents Per Pound for Early Delivery

	June 19	June 20	June 21	June 22	June 24	June 25
Electrolytic copper, N. Y.*	8.75	8.75	8.75	8.75	8.75	8.75
Lake copper, N. Y.	9.12½	9.12½	9.12½	9.12½	9.12½	9.12½
Straits tin, spot, New York	51.10	51.00	51.00	....	51.12½	51.25
Zinc, East St. Louis	4.30	4.30	4.30	4.30	4.30	4.30
Zinc, New York†	4.67½	4.67½	4.67½	4.67½	4.67½	4.67½
Lead, St. Louis	3.85	3.85	3.85	3.85	3.85	3.85
Lead, New York	4.00	4.00	4.00	4.00	4.00	4.00

*Refinery quotations; price ¼c. higher delivered in Connecticut.
†Includes emergency freight charge.

Aluminum, virgin 99 per cent plus, 19c. to 21c. a lb., delivered.
Aluminum, No. 12 remelt, No. 2 standard, in carloads, 16.25c. a lb., delivered.
Nickel, electrolytic, 35c. to 36c. a lb. base refinery, in lots of 2 tons or more.
Antimony, Asiatic, 12.75c. a lb., New York.
Brass ingots, commercial 85-5-5-5, 8c. a lb., delivered; in Middle West ¼c. a lb. is added on orders for less than 40,000 lb.

From New York Warehouse

Delivered Prices, Base per Lb.

Tin, Straits pig	52.25c. to 53.25c.
Tin, bar	54.25c. to 55.25c.
Copper, Lake	10.25c. to 11.00c.
Copper, electrolytic	10.00c. to 10.50c.
Copper, castings	9.75c. to 10.75c.
*Copper sheets, hot-rolled	16.00c.
*High brass sheets.	14.25c.
*Seamless brass tubes	16.00c.
*Seamless copper tubes	16.25c.
*Brass rods	12.75c.
Zinc, slabs	5.75c. to 6.75c.
Zinc, sheets (No. 9), casks, 1200 lb. and over	10.25c.
Lead, American pig	4.50c. to 5.60c.
Lead, bar	5.50c. to 6.50c.
Lead, sheets	7.75c.
Antimony, Asiatic	13.50c. to 14.50c.
Alum., virgin, 99 per cent, plus	23.30c.
Alum., No. 1 for remelting, 98 to 99 per cent	18.00c. to 19.00c.
Solder, ½ and ½	29.50c. to 30.50c.
Babbitt metal, commercial grades	25.00c. to 60.00c.

*These prices are also for delivery from Chicago and Cleveland warehouses.

From Cleveland Warehouse

Delivered Prices per Lb.

Tin, Straits pig	55.00c.
Tin, bar	57.00c.
Copper, Lake	10.00c.
Copper, electrolytic	10.00c.
Copper, castings	9.75c.
Zinc, slabs	5.75c. to 6.00c.
Lead, American pig	4.65c. to 5.40c.
Lead, bar	8.00c.
Antimony, Asiatic	15.00c.
Babbitt metal, medium grade	10.25c.
Babbitt metal, high grade	59.00c.
Solder, ½ and ½	32.25c.

Old Metals, Per Lb., New York

Buying prices are paid by dealers for miscellaneous lots from smaller accumulators, and selling prices are those charged to consumers after the metal has been prepared for their uses. (All prices are nominal.)

	Dealers' Buying Prices	Dealers' Selling Prices
Copper, hvy, crucible	5.75c.	6.50c.
Copper, hvy. and wire	5.62½c.	6.12½c.
Copper, light and bottoms	4.62½c.	5.12½c.
Brass, heavy	3.12½c.	3.75c.
Brass, light	2.37½c.	3.12½c.
Hvy. machine composition	4.87½c.	5.37½c.
No. 1 yel. brass turnings	4.12½c.	4.62½c.
No. 1 red brass or compos. turnings	4.37½c.	4.87½c.
Lead, heavy	2.87½c.	3.25c.
Zinc	2.25c.	2.62½c.
Cast aluminum	10.62½c.	11.75c.
Sheet aluminum	12.00c.	13.50c.

Reinforcing Steel

Awards 3000 Tons—New Projects 6000 Tons

AWARDS

New York, 230 tons, approaches for Tri-borough bridge; from Tully & Di Napoli, Inc., general contractor, to Truscon Steel Co.

State of Ohio, 750 tons, through Winston Brothers, St. Paul, Minn., to Concrete Engineering Co.

Cleveland, 1037 tons, Cedar-Central Federal housing project, to Truscon Steel Co.

Woodville, Pa., 500 tons, Allegheny County Home addition, to Metzger-Richardson Co., Pittsburgh.

Berkeley, Cal., 285 tons, Folger Avenue crossing, to Soule Steel Co.

Sacramento, Cal., 200 tons, Montgomery Ward building, to an unnamed bidder.

NEW REINFORCING BAR PROJECTS

Quincy, Mass., 100 tons, school.

Sycamore, Ill., tonnage being estimated, sewage disposal plant.

Pekin, Ill., tonnage not stated, school building.

Chicago, 100 tons, store addition at 669 North Michigan Boulevard.

Indianapolis, 1000 tons for housing project.

State of Ohio, 600 tons, northern conservation district.

Zanesville, Ohio, 600 tons, Pleasant Hill Dam, York Engineering & Construction Co., York, Pa., low bidder for general contract.

Casper, Wyo., 1275 tons, Seminoe dam and power plant on Alcova project; bids July 22.

San Francisco, 500 tons, United States mint; bids July 25.

Los Angeles, 2425 tons, San Rafael and Monrovia tunnels for Metropolitan Water District; bids July 23.

Railroad Equipment

Chesapeake & Ohio has ordered 5125 freight cars, distributed as follows: 2000 50-ton hoppers from American Car & Foundry Co., Huntington, W. Va.; 1500 50-ton hoppers from Pullman-Standard Car Mfg. Co., Butler, Pa.; 1500 50-ton hoppers from General American Car Co., East Chicago, Ind.; 50 40-ton single deck stock cars from General American Car Co., and 75 50 ton steel underframe flat cars from Bethlehem Steel Co., Johnstown, Pa.

Canadian Pacific has asked for bids on 750 box, 300 coal and 150 refrigerator cars.

Canadian National is in market for 250 refrigerator, 300 box, 150 sand and 400 automobile cars and for an undetermined number of freight and passenger locomotives.

United Carbon Co. has ordered two covered hopper cars from American Car & Foundry Co.

United Fruit Co. is inquiring for 5, 10 or 15 passenger cars for export.

Norfolk Southern has been granted a loan of $1,040,000 from PWA for construction of 500 steel box cars in its own shops at a cost of $1,155,000. Railroad will supply balance of necessary funds.

Memphis Street Railway Co., Memphis, Tenn., has placed order for 26 H-13-S coaches with American Car & Foundry Motors Co., subsidiary of American Car & Foundry Co.

Washington, Baltimore & Annapolis Electric Railroad, which has been in receivership since 1931, has been sold at auction to Hyman-Michaels Co., Chicago, for $139,000. Road will be dismantled and sold for scrap.

HIDDEN STRENGTH!

Using the same dies, drop forgers can strike out a forging of alloy steel or carbon steel but the two would be far apart as to inherent strength.

Hammer boards, too, have somewhat similar differences in strength even though physical dimensions be the same.

In "Silveroc", drop forgers have a hammer board of rugged strength and durability. Made from selected Pennsylvania Rock Maple patiently air-dried and scientifically cut.

As one item in effecting lower cost of operating drop hammers, "Silveroc" Hammer Boards merit your consideration. We also furnish "Durock" Hammer Boards—a durable rock maple product.

H.G.IRWIN
LUMBER CO.
ERIE, PA.
SILVEROC
TRADE MARK

RAILS AND TRACK SUPPLIES

Wabash has ordered 5000 tons of 112-lb. rails for July and August delivery. Illinois Steel Co. will supply 2500 tons and Inland Steel Co. and Bethlehem Steel Co. 1250 tons each.

United States Engineers, Portland, Ore., have awarded 225 tons of spikes, bolts and tie plates to Colorado Fuel & Iron Co., and 667 tons of rails and 78 tons of angles to Columbia Steel Co.

Cast Iron Pipe

Chicago has placed 200 tons of special fittings with Lynchburg Foundry Co. and 100 tons of offset fittings with James B. Clow & Sons.

Pine Grove, W. Va., plans water pipe line; also new reservoir and other waterworks construction. Cost about $45,000. Bernard G. Sampson & Co., Fairmont, W. Va., are consulting engineers.

Stella, Neb., plans pipe lines for water system. Fund of about $25,000 is being arranged through Federal aid for this and other waterworks installation. Henningson Engineering Co., Union Bank Building, Omaha, Neb., is consulting engineer.

Eureka, Utah, has approved bond issue for pipe lines for water system and other waterworks improvements, including 300,000 gal. reservoir and pumping equipment. Cost about $50,000. A. Z. Richards, Salt Lake City, Utah, is consulting engineer.

Sayreville, N. J., plans pipe line extensions in water system. Fund of $20,000 is being secured through Federal aid. A. A. McMichael is borough engineer.

Jackson, Tenn., asks bids until July 10 for 6 to 20-in. for water system extensions; also for other waterworks construction and sewage system improvements. Fund of $175,000 has been arranged for entire project. E. R. Dike is city engineer.

Cherryvale, Kan., plans water pipe lines and other waterworks improvements. Estimates of cost will be made at once by E. T. Archer & Co., New England Building, Kansas City, Mo., consulting engineers, and financing arranged.

Steele, N. D., plans pipe lines for water system and other waterworks construction. Financing will be arranged soon. Ray Engineering Co., Wahpeton, N. D., is consulting engineer.

Kennewick, Wash., plans water pipe lines and other waterworks equipment. Financing is being arranged through Federal aid.

Two Harbors, Minn., plans about 8300 ft. of 20-in. and 2500 ft. of 12-in. for main water line; also about 1000 ft. of steel pipe for intake system. New pumping plant and other waterworks improvements are planned. Fund of about $100,000 will be arranged through Federal aid.

Mason, Tex., plans pipe lines for water supply; also other waterworks installation. Fund of $40,000 is being arranged through Federal aid.

Sonora, Tex., plans pipe lines for water system and installation of other waterworks equipment. Cost about $65,000. H. R. F. Helland, Frost National Bank Building, San Antonio, Tex., is consulting engineer.

Winchester, Va., plans main pipe lines for water supply; also extensions in distribution system and other waterworks construction, including development of additional source of supply at Cedar Creek. Fund of $532,000 is being arranged through Federal aid. Arthur M. Field is city manager in charge.

San Bernardino, Cal., has divided 232 tons of 8 and 12-in. between United States Pipe & Foundry Co. and R. D. Wood & Co.

San Francisco, will open bids June 28 on 127 tons of 6-in.

Detroit Scrap Market Is Dull

DETROIT, June 25.—With consumers showing slight interest, the local scrap market continues to drag. Some dealers report that material is increasingly hard to secure, especially with automotive production tapering seasonally. Prices of new factory busheling and flashings are off 25c. a ton, but otherwise quotations are unchanged. Water shipments in good volume are being made to Buffalo, Cleveland and Lorain

Fabricated Structural Steel

Lettings Higher—New Projects in Large Volume

STRUCTURAL steel awards of 27,000 tons, the third largest for the year, are swelled by 9700 tons for an addition to the Library of Congress, Washington, and 4400 tons for trestles for the Grand Coulee dam in the State of Washington. New projects of 56,675 tons are the heaviest since the third week in February and include 20,000 tons for an addition for the Department of the Interior, Washington, 15,000 tons for five locks and four dams in the Mississippi River, and 6500 tons for transmission lines for the Metropolitan Water District, Los Angeles. Plate awards call for 1620 tons. Sheet piling projects of 25,000 tons include 14,000 tons for five locks and four dams in the Mississippi River, 6000 tons for the second section of the levee wall at Monroe, La., and 5000 tons for the Pickwick dam in Tennessee. Structural steel awards for the week follow:

NORTH ATLANTIC STATES

Brooklyn, 100 tons, alterations to Acme Packing plant, to Belmont Iron Works.

Brentwood, N. Y., 125 tons, Pilgrim State Hospital building, to Lehigh Structural Steel Co.

Creedmoor, N. Y., 100 tons, assembly hall for Brooklyn Hospital, to Belmont Iron Works.

Olean, N. Y., 1000 tons, high school, to McClintic-Marshall Corpn.

Woodville, Pa., 595 tons, buildings for Allegheny County Home, to Fort Pitt Bridge Works Co.

Pittsburgh, 245 tons, St. Mary of Mercy Church, to Guibert Steel Co.

Washington, 9700 tons, addition to Library of Congress, to McClintic-Marshall Corpn.

SOUTH AND SOUTHWEST

Wheeler Dam, Ala., 1200 tons, radial gates, to Lakeside Bridge & Steel Co.

State of Georgia, 385 tons, Savannah River Bluff Dam gates, to Virginia Bridge & Iron Co.

New Orleans, 555 tons, Bayou St. John bridge, to Jones & Laughlin Steel Corpn.

Houma, La., 200 tons, Intra-Coastal Canal bridge, to Vincennes Bridge Co.

Roger Mill County, Okla., 565 tons, bridge, to J. B. Klein Iron & Foundry Co.

Comal County, Tex., 300 tons, bridge, to Pittsburgh-Des Moines Steel Co.

CENTRAL STATES

Hiram, Ohio, 135 tons, Hiram College building, to Jones Brothers Structural Steel Co., Ravenna, Ohio.

Detroit, 190 tons, Bundy Tubing plant addition, to R. C. Mahon.

Gary, Ind., 600 tons, mold building, to American Bridge Co.

Galena, Ill., 390 tons, Jo Daviess County overhead, to Duffin Iron Co.

Glenview, Ill., 600 tons, overhead crossing, to American Bridge Co.

Gurnee, Ill., 220 tons, subway, to Milwaukee Bridge Co.

Chicago, 500 tons, Liquid Carbonic Corpn., to an unnamed bidder.

South Chicago, Ill., 275 tons, Republic Steel Corpn. mill building, to an unnamed bidder.

Palisade, Ill., 225 tons, bridge, to McClintic-Marshall Corpn.

Waukegan, Ill., 300 tons, Johns Manville Co., to American Bridge Co.

Jasper County, Mo., 130 tons, bridge, to St. Joseph Structural Steel Co.

Columbus, Neb., 1250 tons, beam spans, to Worden-Allen Co.

Monroe, Neb., 160 tons, power house, to Lincoln Steel Works.

WESTERN STATES

Almira, Wash., 4400 tons, construction trestle at Grand Coulee dam, to Columbia Steel Co.

Almira, 700 tons, cement silos at Grand Coulee dam, to Pittsburgh-Des Moines Steel Co.

Almira, 800 tons, four cranes at Grand Coulee dam, to Wallace Bridge & Structural Steel Co.

Lakeview, Wash., 183 tons, State undercrossing, to Pacific Car & Foundry Co.

Pomona, Cal., 100 tons, factory for California Fruit Wrapping Mills, to Pacific Iron & Steel Co.

San Francisco, 100 tons, Girls' High School, to Schrader Iron Works.

Bonneville, Ore., 450 tons, bridge, to Wisconsin Bridge & Iron Co.

Honolulu, T. H., 125 tons, plantation warehouse, to Isaacson Iron Works.

Hawaii, 100 tons, Waiakes Mill Co., buildings, to Virginia Bridge & Iron Co.

CANADA

British Columbia, 5000 tons, bridge over Fraser River, to Dominion Bridge Co.

NEW STRUCTURAL STEEL PROJECTS

NORTH ATLANTIC STATES

Montague, Mass., 400 tons, State bridge.

New York, 1250 tons, Bronx County jail house.

Staten Island Rapid Railroad, 750 tons, grade crossing eliminations at Port Richmond, N. Y.

Meadville, Pa., unstated tonnage, Viscose Co. building additions.

Tottenville, N. Y., 1100 tons, high school; erroneously reported awarded; **Psaty & Furhman, Inc.,** New York, general contractor.

Washington, 20,000 tons, addition to Department of Interior building; bids July 19.

Washington, 500 tons of sheets and unspecified tonnages of plates, structural steel and castings, book racks for Library of Congress addition; general contract awarded to Snead & Co., Jersey City, N. J.

SOUTH AND SOUTHWEST

Coal Creek, Tenn., 1075 tons, power plant.

Yuma, Ariz., 500 tons, desilting works on All American Canal; bids July 7.

Wickenburg, Ariz., 375 tons, State highway bridge.

CENTRAL STATES

Cambridge, Ohio, 225 tons, bridge.

Mansfield, Ohio, 375 tons, bridge.

Brinkhaven, Ohio, 300 tons, bridge.

Dover, Ohio, 1475 tons, bridge.

Elyria, Ohio, 350 tons, building for Western Automatic Machine Screw Co.; new bids taken June 26.

East Liverpool, Ohio, 275 tons, Hall China Co. plant alterations.

Cincinnati, 250 tons, store building for Emery & Sons Co.

Detroit, 1500 tons, Briggs Mfg. Co. addition.

Detroit, 1750 tons, Stroh Brewery wash house and stock cellars.

Alton, Ill., 300 tons, Owens Illinois Glass Co.

Chicago, 550 tons, boat repairs.

Canton, Mo., 200 tons, tainter gates for dam No. 20, Mississippi River; Lakeside Bridge & Steel Co., low bidder.

Mississippi River, 15,000 tons, five locks and four dams.

WESTERN STATES

Casper, Wyo., 500 tons, Seminoe dam and power plant on Alcova project; bids July 22.

San Francisco, 800 tons, United States mint; bids July 28.

Los Angeles, 165 tons, tunnel ribs for Metropolitan Water District, Specification 113; bids July 1.

Los Angeles, 6500 tons, transmission line for Metropolitan Water District; bids Aug. 20.

Los Angeles, 850 tons, San Rafael and Monrovia tunnels; bids July 23.

Bonneville Dam, Ore., 1480 tons, lock operating equipment; bids July 10.

FABRICATED PLATES

AWARDS

New Haven, Conn., 285 tons, tank for T. A. D. Jones & Co., Inc., to Chicago Bridge & Iron Works.

Pittsburgh, 550 tons, bulk station tanks for Atlantic Refining Co. between Pittsburgh and Harrisburg, Pa., to Chicago Bridge & Iron Co.

Minneapolis, 200 tons, dredge pipe, to Williams Brothers Boiler & Mfg. Co.

Los Angeles, 185 tons, pipe for Department of Water and Power, to Southern Pipe & Casing Co.

Boulder City, Nev., 100 tons, discharge guides, Specification 680-D, to Babcock & Wilcox Co.

Longview, Wash., 300 tons, tank for Texaco Oil Co., to Chicago Bridge & Iron Works.

NEW PROJECTS

Elkhorn, Wis., 125 tons, elevated water tank, city waterworks; bids about July 10.

Casper, Wyo., 170 tons, Seminoe dam and power plant; bids July 22.

SHEET PILING

AWARDS

New York, 220 tons, foundation cylinders for Trinity Church, 180 tons to Steel & Alloy Tank Co., 40 tons to Scully Products Co.

Columbus, Ohio, 850 tons, Main Street bridge, to Ben Tom Supply Co., Columbus; Jones & Laughlin Steel Corpn. will furnish steel.

Zanesville, Ohio, 170 tons, Fair Oaks dam in connection with Muskingum District conservancy project, to Jones & Laughlin Steel Corpn.

NEW PROJECTS

Pickwick Dam, Tenn., 5000 tons, T. V. A. project, opening of bids postponed until June 28.

Monroe, La., 6000 tons, second section of levee wall; bids about middle of July.

Mississippi River, 14,000 tons, five locks and four dams.

Large Tonnages Come Out on Coast

SAN FRANCISCO, June 24. — Major tonnages are involved in several projects advertised during the past week. The Metropolitan Water District will open bids at Los Angeles on Aug. 20 for the construction of the 237-mile transmission line from the Boulder Dam power plant. Approximately 6500 tons of structural steel will be furnished either by the contractor or the district under the alternates of the contract. Approximately 2425 tons of reinforcing bars, 850 tons of structural steel and an unannounced plate tonnage will be required for the San Rafael and Monrovia tunnels on which the district has called for bids.

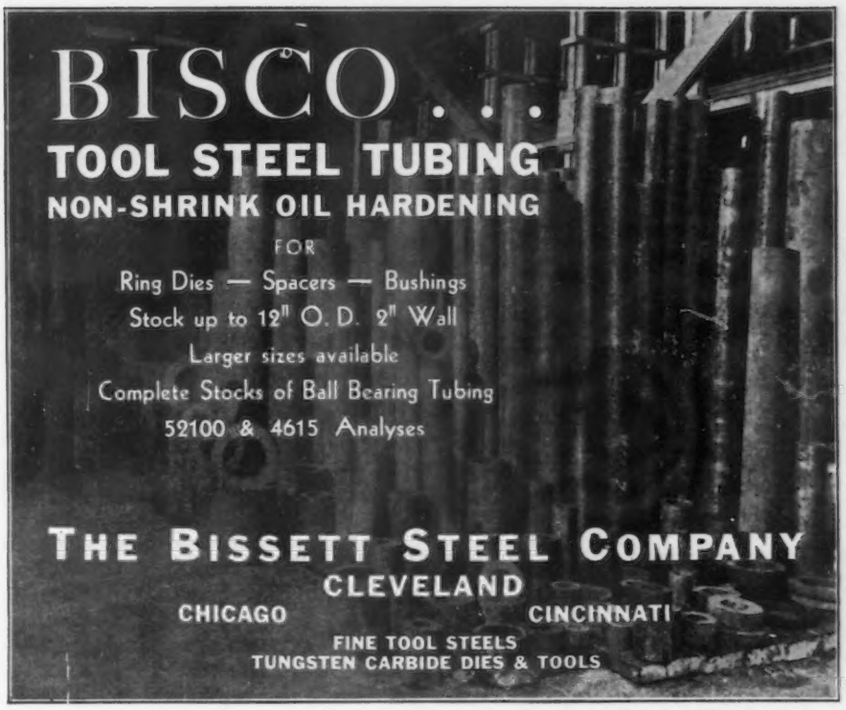
At Portland, Ore., specifications have been issued for gates, lock-operating equipment and gantry cranes for Bonneville Dam. Approximately 5600 tons of shapes are involved in the gates and cranes, while an additional 1480 tons will be included in the operating equipment. The Bureau of Reclamation will open bids July 22 at Casper, Wyo., for the construction of the Seminoe Dam and power plant on the Alcova Project. The placing of 1275 tons of reinforcing bars, 501 tons of structural steel and 970 tons of miscellaneous steel is involved. The United States mint at San Francisco, for which bids will be opened July 25, will include approximately 800 tons of shapes and 500 tons of bars.

Outstanding among the structural lettings during the past week was the booking of 4400 tons by Columbia Steel Co. for a construction trestle at Grand Coulee Dam near Almira, Wash. It is reported that Pittsburgh-Des Moines Steel Co. took 700 tons for silos and Wallace Bridge & Structural Co. booked 800 tons for cranes at Grand Coulee Dam. Although structural bookings aggregated 6842 tons, few reinforcing bar or plate awards were reported.

The listing of major projects during the week has stimulated a quiet market and strongly indicates the start of the expenditure of huge Federal funds in the West.

Light-Weight Cars Exhibited at Chicago

A number of light-weight freight cars are being exhibited at Chicago this week on the occasion of the annual convention of the Mechanical Section of the Association of American Railroads. The Pullman-Standard Car Mfg. Co. is showing a box car constructed of Cor-Ten steel and the Ralston Car Co. is exhibiting a hopper car built of RR-11 rustless iron supplied by the Rustless Iron Co. of America. The Chesapeake & Ohio is showing a hopper car, built by the American Car & Foundry Co. of Cor-Ten and Man-Ten steels, and the Mount Vernon Car & Mfg. Co. is showing a box car built of high-tensile steel, which is described in an article elsewhere in this issue.



Machine Tool and the Economic Situation

(CONTINUED FROM PAGE 39)

products of highly mechanized industries. The current development of the factory-built steel house is given its opportunity in the relative disproportion of costs of buildings as compared to the prices of other products.

The production of every convenience has its roots in machine tools, and without their constant improvement the products which give the most material enjoyment to our people could not be supplied to a wide range of people at costs within their reach; nor could the continual reduction in hours of work persist, allowing more time for the enjoyment of leisure; nor could so many people benefit from the advantages of more and more cultural education.

The conveniences and comforts that contribute to a higher standard of living for American people have been an inspiration to the more backward countries of the world. As a consequence, a good proportion of the industry's production has been absorbed in the export markets. Russia under her planned economy program has been a liberal purchaser and user of America's modern machine tools. Even though her political, economic, and social system is diametrically the opposite of ours, Russia recognized from the beginning that if she hoped to raise her country and her people to the level of her more advanced neighbors, the development of the capital goods industries must come first as a foundation for the satisfaction of all other wants.

The machine tool industry cannot claim credit for all the bounties of America's economic life, but it is fitting to point out that it is the foundation of the machine age; that from its tools come those other machines for the elimination of human drudgery; that it is responsible for the reduction of costs which permit more people to enjoy the comforts which fashion a better and happier life; that it has gradually and continuously shortened the working day; that it has made it possible for people to travel swiftly and safely over long distances; that it has furnished highly trained men of sterling character and integrity to other industries everywhere; that it has lightened man's work in the field and factory, and woman's duties in the home; that it has opened new and easier ways of livelihood for millions.

A.S.T.M. Investigates Hardness Testing And Creep of Aluminum Alloys

(CONTINUED FROM PAGE 27)

finement may have a deleterious effect on the creep characteristics of aluminum alloys. The other alloys tested had higher creep rates than alloys Nos. 1 and 1-A, the cast alloys in general having better creep characteristics than the forged alloys, though a few exceptions may be noted. Cast alloy No. 8 (6 per cent magnesium, 1.5 per cent nickel, 1 per cent manganese) had the highest creep rate of the alloys tested.

Effect of Tests on Alloys

The hardness of the alloys was greatly reduced by prolonged exposure to testing temperatures, as shown in Table V. Hardness tests were made on the shoulder of the specimen as near the gage length as possible, after the specimen had cooled to room temperature. This portion of the specimen had been heated to the testing temperature for the period of the test, but had not been excessively strained by the load applied. Forged alloy No. 1-A (4 per cent copper, 2 per cent nickel, 1.5 per cent magnesium) had the highest hardness of the alloys tested after 500 hr. heating at 400 deg. F., while alloy No. 8 (6 per cent magnesium, 1.5 per cent nickel, 1 per cent manganese), which had the highest creep rate of the series, had the highest hardness after 300 hr. heating at 600 deg. F.

A number of specimens were examined under the microscope to determine the effect of heating on the structure of the alloys. The most notable structural change observed was the abundant precipitate produced by the long period of heating. Aluminum alloys low in manganese, when heat treated to produce maximum tensile properties, generally show no evidence of a precipitated constituent that can be detected by microscopic examination. The structure of alloy No. 2 (10 per cent copper, 1 per cent iron, 0.25 per cent magnesium) in the heat-treated condition (Fig. 3(a)) may be considered typical. The solution treatment served to dissolve all of the soluble constituents which could go into solid solution under the conditions employed. The alloy after solution treatment consists of solid solution, excess soluble constituents and insoluble compounds. The aging treatment, while it greatly improves the mechanical properties of the alloy, does not alter the microstructure. The particles of precipitate, if the aging treatments ordinarily applied actually cause precipitation, are submicroscopic. Exposure to a temperature of 400 deg. F. for 500 hr. produces particles of precipitate which are readily detectable, as shown in Fig. 3(b), although 400 deg. F. is in the aging range for aluminum alloys. A temperature of 600 deg. F. is in the annealing range, so a rapid growth of the particles of precipitate would be expected. Figure 3(e) shows a specimen of alloy No. 2 which was heated to 600 deg. F. for 300 hr.

Interpretation of Results

The mechanical properties of the alloys at room temperature apparently bear no relation to the creep characteristics at elevated temperatures. Some of the alloys, such as alloy No. 6 (4 per cent copper, 2 per cent nickel, 0.5 per cent magnesium), had high strength at room temperature and relatively poor creep characteristics. Due to the progressive loss of strength which takes place when aluminum alloys are heated to elevated temperatures for long periods, it would not be expected that the creep characteristics could be deduced from the results of short-time tests at those temperatures. Both types of tests were run on cast alloys Nos. 1, 2, 3 and 4 under comparable conditions. When these alloys are listed in the order of their tensile strengths as determined by short-time tests at 400 deg. F., alloy No. 1 has the highest tensile strength, followed in order by alloys Nos. 2, 3 and 4. The results of creep tests indicate that the alloys fall in the same order. Alloy No. 8, however, which has a short-time tensile strength between alloys Nos. 3 and 4, has an extremely high creep rate. At 600 deg. F. the positions of alloys Nos. 3 and 4 are reversed, both in long-time and in short-time tests.

Insufficient data were available for the wrought alloys, so the relationship between the cast and the wrought alloys could not be deduced.

In conclusion Mr. Kennedy stated that caution should be used in applying the results of creep tests to the design of airplane engine parts due to the difference between test conditions and service conditions. In a creep test, both the load and the temperature are constant for the period of the test, while in an airplane engine the parts are subjected to vibration, often to alternating tensile and compressive stresses and the temperature fluctuates according to operating conditions. The results of creep tests should be of value, however, in indicating the relative behavior of the various alloys at operating temperatures.

Some correlation has been observed between creep characteristics and service performance in the case of air-cooled cylinder heads for airplane engines. These parts are cast from alloys Nos. 1 and 2, which have good creep characteristics. They have proven satisfactory in service and few failures have been reported. Recently cylinder heads of the same type have been cast from alloy No. 8, which has poor creep characteristics. Many of these cylinder heads have failed during block tests of the engine. Alloy No. 8 has low heat conductivity, so these cylinder heads operate at temperatures approximately 50 deg. F. higher than cylinder heads cast from alloys Nos. 1 and 2. The higher operating temperature would tend to lower the mechanical properties of the alloy, but it is probable that the high creep rate is an important factor in the failure of the cylinder heads.

The same correlation has not been observed in the case of airplane engine pistons. These parts were formerly cast from alloys Nos. 1 and 2, but are now forged from alloys Nos. 5 and 7, which have poorer creep characteristics. The wrought alloys have given satisfactory service in spite of their high creep rates. As in the case of the cylinder heads, a difference in operating temperature is probably a contributing factor, because, due to changes in piston design, the wrought pistons run cooler than do the cast pistons.

Welds Stress-Relieved By Portable Electric Heaters

(CONTINUED FROM PAGE 29)

around the nozzle and pipe. The heater includes heat insulation, refractory plates, nickel-chromium coil type heating elements, plug type terminals with plugs for portable cable connection, etc. The heating plates are backed by solid heat insulation around the sides and on each end. The heater, together with insulation, is assembled in sheet-metal casing having high-temperature insulating board ends.

Provisions are made for inserting a thermocouple into each of the heater sections through the heat insulation and refractory plate of the heating unit for reading the temperature of the weld.

One size of heater can be used for several sizes of pipe and nozzles, and it is possible to accomplish stress relieving of a range of pipe and nozzle sizes by inserting refractory bushing for the smaller sizes into the ends of the heater as well as the top opening, provided the flange of the nozzle extends sufficiently above the top of the heater. In the event the flange extends flush with the top of the heater, replaceable insulated heads are used instead of bushings.

The heating area of the nozzle heaters is such as to assure uniform heat over the specified length of pipe and nozzle to be stress relieved. A heater of 6.5-kw. capacity is sufficient to permit bringing the temperature of a 4-in. pipe of 0.337-in. maximum thickness with a 2½-in. nozzle of 0.0276-in. thickness up to 1200 deg. F. in about 1 hr. from cold (70 deg. F.) when starting the heater cold. For stress-relieving succeeding welds after the heater has been thoroughly heat saturated the time is reduced to about ½ hr. by means of suitable control equipment; the nozzle and pipe can be held as long as desired at the stress-relieving temperature and then allowed to cool.

The nozzle heaters are supplied in two sections for pipe up to 6 in. in diameter with nozzles up to and including pipe size. For larger pipe and nozzles the heaters are in four sections for strapping around the pipe and nozzles.

Falcon stress-relieving heaters are supplied for operating directly on various standard voltages and can be furnished for operation from welding machine generators if desired. Manual or automatic temperature control equipment can be used.

PRECISION INDUSTRIAL SCREENS

In the preparation of food products and in the screening, sizing and straining operations of chemicals, minerals, stone, coal and other materials, perforated metal plays an important part. H&K standards of quality and accuracy assure you of all that is best in screens. May we aid you in your selection?

Grilles of unusual beauty in exclusive designs suitable for public and commercial buildings and private homes. Ornamental sheets for radiator enclosures and metal furniture are furnished of any metal. Write us for prices and samples.

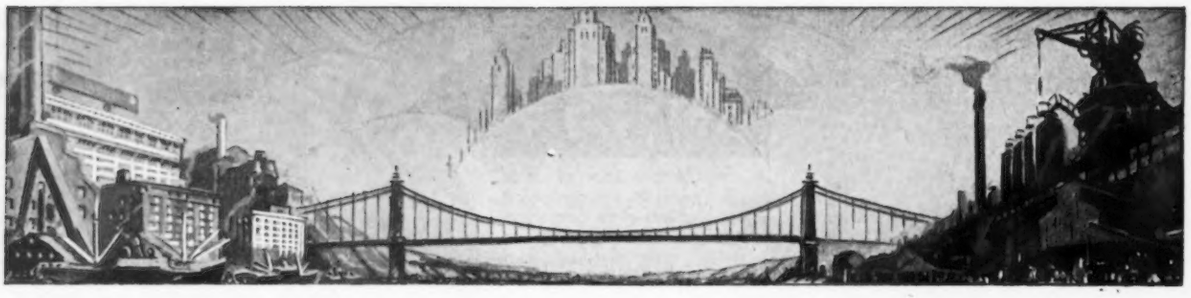
The Harrington & King Perforating Co.

5657 FILLMORE ST., CHICAGO 114 LIBERTY ST., NEW YORK

Sprayed Liquid Takes On Live Rubber Qualities

PAINT spray booths can be treated to a protective coating of rubber, designated as "Kelsanite," applied in liquid form. The product is made by Kelsan Products, St. Clair, Mich.

Simple spray equipment is used in paint-like application of the coating, which can be removed either by hand stripping or by loosening the edges and inserting an air hose under it. Important time and cost savings are claimed for the product and methods of use. Development of the coating is said to have opened up possibilities for its use in metal working plants. As a rust preventer in the storage of metal parts, Kelsanite coated material has been subjected to severe salt-spray tests without showing signs of rust. In the plating of metal parts, it can serve as a masking compound to prevent deposit of metal except where desired and is easily stripped off after the plating operation. Too, it acts as a cleaning compound, absorbing any dirt or moisture on the surface coated. The coating may also be employed in the protection of finished parts and equipment for shipment. Parts may be sprayed or brushed with or dipped in the solution, in sealing the surfaces against air and moisture.



Plant Expansion and Equipment Buying

Bright Prospects Encourage Machine Tool Industry

THE machine tool industry is now beginning to appraise the effects of the Supreme Court's blow to bureaucracy and regimentation in terms of a perceptible increase in investment inquiry. With the lid removed from initiative and efficiency, the prospects are definitely set for an upward surge in the installation of sorely needed capital equipment. Recent announcements of price advances in certain lines give point to this and have had the effect of considerable increase in business closed.

Good business is looked for from the automobile industry, with Chevrolet, Pontiac and McKinnon motors in the vanguard of purchasers.

◀ NORTH ATLANTIC ▶

Continental Can Co., 1 Pershing Square, New York, has purchased entire city block adjoining plant at 1016 East Water Street, Syracuse, N. Y., for an addition, for which plans will soon be drawn. Local plant is given over to production of can-making and can-sealing machinery and parts, also container manufacture.

New York Central Railroad Co., 466 Lexington Avenue, New York, C. C. Warne, purchasing agent, asks bids until July 2 for wire nails, tubing, axles, etc. (Contract 9-1935).

Signal Supply Officer, Army Base, Brooklyn, asks bids until July 9 for 2400 mast sections (Circular 163); until July 15 for 11 rectifiers (Circular 165).

National Can Co., 110 East Forty-second Street, New York, manufacturer of metal cans and containers, has let general contract to Brown & Matthews Co., 122 East Forty-second Street, for new two-story plant, 180 x 280 ft., at Maspeth, L. I. Cost over $200,000 with equipment.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until July 5 for fuel oil burners and spare parts for Brooklyn and Philadelphia navy yards (Schedule 5381); until July 9 for fin tube type heaters for Brooklyn and Charleston navy yards (Schedule 5406).

Board of Education, Park Avenue and Fifty-ninth Street, New York, plans manual training department in new three-story Andrew Jackson high school at St. Albans, Queens, for which building permit has just been issued. Cost about $1,375,000. W. C. Martin, Flatbush Avenue Extension and Concord Street, Brooklyn, is architect and superintendent for board.

American Can Co., 230 Park Avenue, New York, has approved plans for new two-story factory branch, storage and distributing plant at Tampa, Fla. Cost over $150,000 with equipment.

United States Engineer Office, First District, New York, asks bids until July 1 for two portable air compressors (Circular 351), six 4-cu. yd. heavy-duty dump units (Circular 352); until July 2, eight 1½-cu. yd. gasoline shovels (Circular 359); until July 3, 40 1½-cu. yd. heavy-duty dump trucks (Circular 360), one 5-ton heavy-duty dump truck (Circular 361), eight heavy-duty tractors, equipped with hydraulic bull-dozers (Circular 362).

Saratoga Springs Authority, 15 Spring Street, Saratoga Springs, N. Y., has asked bids on general contract for automobile service, repair and garage building for cars and motor trucks. Cost over $100,000 with equipment.

Syndicate Oil Corpn., 200 West Thirty-fourth Street, New York, has taken out permit for new bulk oil storage and distributing plant at Long Island City. Cost about $150,000 with steel tanks and other equipment.

Cadillac Motor Car Co., 70 Columbus Avenue, New York, will expend over $100,000 in improving and equipping 10-story building at 521-31 West Fifty-seventh Street, recently leased for new service repair and parts headquarters for Cadillac and LaSalle automobiles, lately noted in these columns.

Tung Sol Lamp Works, Inc., 95 Eighth Avenue, Newark, N. J., manufacturer of miniature electric lamps, etc., has purchased four-story factory at 370-86 Orange Street, and will improve for new plant, taking immediate possession. Present works will be continued as heretofore.

Board of Education, Teaneck, N. J., plans manual training department in new multi-story school, for which bids have been asked on general contract. Fund of $635,000 has been secured through Federal aid for building and equipment. Hacker & Hacker, 201 Main Street, Fort Lee, N. J., are architects.

Philadelphia Insulated Wire Co., 200 North Third Street, Philadelphia, manufacturer of electrical wires and cables, has purchased five story factory at 307 Race Street for new plant.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until July 2 for following motor-driven machines: one tool makers' precision lathe (Schedule 5399), one gear-inspection machine (Schedule 5390), two engine lathes (Schedule 5387), one precision type balancing machine (Schedule 5394); until July 5, four gear shapers (Schedules 5408, 5414, 5416, 5417), one sandblast cleaning cabinet, with complete dust-collecting equipment (Schedule 5410), four tool room precision lathes (Schedule 5420), two mallet bumping hammers (Schedule 5412), 50 portable ventilating sets (Schedule 5427), for Philadelphia Navy Yard.

◀ NEW ENGLAND ▶

Brookfield Iron Works, Brookfield, Conn., recently acquired by new interests, known as J. A. B. Holding Corpn., has let general contract to Ardwino Montesi, Brookfield, for two-story addition and improvements in present works. Cost over $30,000 with equipment.

United States Engineer Office, First District, New York, asks bids until July 2 for five 1½-cu. yd. gasoline shovels, for Waterbury, Vt. (Circular 355).

Atlantic Wire Co., Branford, Conn., manufacturer of wire products, has let general contract to Mariana Construction Co., 222 Forbes Avenue, New Haven, Conn., for three-story wire mill, 80 x 150 ft.; three-story storage and distributing building, 80 x 120 ft.; one-story storage unit, 60 x 140 ft., and one-story metal-cleaning and shop building, 35 x 150 ft. Cost close to $150,000 with equipment. Leo F. Caproni, 742 Elm Street, New Haven, is architect and engineer.

Sudbury Brass Goods Co., Boston, has been organized by Allan P. Lindblad, 10 Maple Road, Winchester, Mass., and associates, to manufacture brass specialties.

Milwaukee Beverage Co., 162 Riverway Street, Boston, liquors, has let general contract to Concrete Construction Co., 11 Garfield, Avenue, Chelsea, for new one-

QUALITY TAGS

are available to all manufacturers of bed springs, spring mattresses and furniture who use Wissco Gamma Spring Wire in their production.

GAMMA spring wire

All upholstery with springs made of Wissco Gamma Spring Wire maintains its luxuriousness longer. The resilience, strength, toughness and uniformity make it an outstanding spring wire.

Scientific research both as to requirements of the wire in use and the handling of the wire in manufacture have resulted in these characteristics for this special purpose. The requirements of other industries are similarly studied and a Wissco Wire produced that exactly meets them. Write us for information about a Wissco Wire that can be especially produced for your specific needs.

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WICKWIRE SPENCER STEEL COMPANY
New York City, Buffalo, Chicago, Worcester;
Pacific Coast Headquarters: San Francisco;
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Wissco Wire
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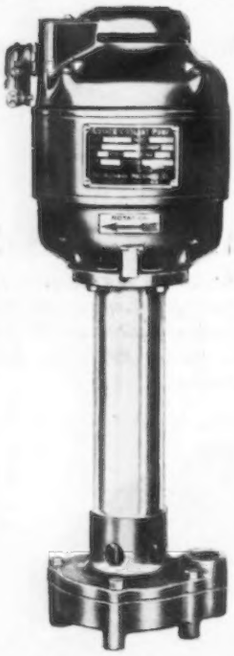
Wickwire Spencer manufactures High and Low Carbon Wires—in various tempers, grades and finishes—for your specific purpose. Hard-Drawn, soft or annealed Basic or Bessemer Wires—Hard-Drawn annealed, or oil-tempered Spring Wire, Chrome Vanadium Spring Wire—Valve Spring—Music—Clip—Pin—Hairpin—Hook and Eye—Broom—Stapling—Bookbinding—Machinery Spring Wire—Reed Wire—Clock—Pinion—Needle-Bar—Screw Stock—Armature Binding—Brush—Card—Florist—Mattress—Shaped—Rope—Welding. Flat Wire and Strip Steel, High or Low Carbon—Hard, annealed or tempered—Clock Spring Steel—Corrosion and Heat Resisting Wires. Consult the Wissco technical man on your wire problems, however large or small.



"GUSHER"

COOLANT PUMPS-

Operate with minimum friction because of the fact that they are full ball-bearing, and have no stuffing boxes. There are no metal to metal contacts within the Pump housing, and, therefore, non-lubricating liquids can be handled efficiently and dependably as well.

GUSHER PUMPS will save you money in the long run.

THE RUTHMAN MACHINERY CO.
Cincinnati, Ohio

story and basement storage and distributing plant. Cost about $45,000 with equipment.

Department of Public Institutions, State House, Augusta, Me., has plans for new steam power plant for central heating service, and one-story mechanical laundry at institution at Skowhegan, Me. Cost about $65,000 with equipment. A. J. Thayer Co., 2 Spring Street Extension, Auburn, Me., is consulting engineer.

Board of Education, Watertown, Mass., is inquiring for electrical and machine shop equipment for a senior high school.

BUFFALO DISTRICT

Tide Water Oil Co., 17 Battery Place, New York, will soon begin erection of new bulk oil storage and distributing plant at Syracuse, N. Y., for which general contract recently was let to Byrne Construction Co., 411 Roberts Avenue, Syracuse. Cost over $75,000 with steel tank and other equipment.

Iroquois Gas Corpn., Iroquois Building, Buffalo, has taken out permit for new one-story equipment storage, distributing and service building, for which general contract recently was let to Crooker, Carpenter & Skaer, Inc., 120 Hardwood Place. Cost about $35,000 with equipment.

WASHINGTON DIST.

Rodgers & Townsend, operating a ship repair works at yard of Redmanvane Shipbuilding Co., Key Highway, foot of Warren Street, Baltimore, have leased about five acres of waterfront property on Rock Creek as site for new shipbuilding and repair plant, marine railway, dock and other structures. Cost over $80,000 with equipment. John B. Rodgers and O. K. Townsend are heads.

General Purchasing Office, Panama Canal, Washington, asks bids until July 2 for one gasoline engine-driven portable conveyor for handling dirt and other materials, four chemical dry feed machines, forged steel turnbuckles, chain shackles, galvanized steel ring bolts, galvanized steel wire cloth, galvanized steel wire poultry netting, galvanized iron pipe turnbuckles, one ammeter, two voltmeters, two rotating standards, disconnecting switches, cutouts, fuses and other equipment (Schedule 3067).

Owings Mill Distillery Co., Owings Mill, Md., has let general contract to G. Walter Tovell, Inc., Eutaw and Monument Streets, Baltimore, for six-story addition, 70 x 80 ft., for storage and distribution. Cost close to $90,000 with equipment.

Baltimore Motor Oil Co., Baltimore, C. P. Whitelock, manager, has acquired property at West Baltimore Avenue and line of Chesapeake & Ohio Railroad, and will remodel for new bulk storage and distributing plant, with department for reclaiming of motor oils.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until July 2 for copper tubing (Schedule 5366), electric cable, cord and wire (Schedule 5384); until July 5, copper-nickel-alloy and admiralty metal (Schedule 5367), for Eastern and Western navy yards.

OHIO AND INDIANA

Western Automatic Machine Screw Co., Engineers Building, Cleveland, has rejected bids recently received for one-story addition, 190 x 209 ft., to plant at Elyria, Ohio, and will have revised plans prepared. Cost about $115,000 with equipment. John B. Fischer, 7322 Lafayette Street, Chicago, is architect. B. C. Franklin is general manager at Elyria.

City Council, Piqua, Ohio, F. R. Beuchner, city manager, plans extensions in transmission lines from municipal electric light and power plant for service in suburban districts. Cost close to $30,000 with equipment.

Fryer Engineering & Tool Co., Dayton, Ohio, has been organized by William H. Fryer and Guy H. Wells, care of W. H. Turner, 201 Beckel Building, representative, to manufacture tools and other equipment.

Board of Education, Dillonvale, Ohio, has plans for new one-story industrial art school, for which appropriation has been arranged through Federal aid. Superstructure will begin soon.

Joslyn Co., 1701 McKinney Street, Fort Wayne, Ind., manufacturer of pole line equipment and supplies, affiliated with Joslyn Mfg. & Supply Co., same address, has let general contract to Abell-Howe Construction Co., 20 North Wacker Drive, Chicago, for new one-story mill, 84 x 485 ft., primarily for raw material service. Installation will include a 25-ton electric furnace, with accessories, and 20-ton electric traveling crane. Cost about $150,000 with machinery.

Sibley Machine Co., Sample Street, South Bend, Ind., manufacturer of drilling machinery and parts, iron castings, etc., has closed bids on general contract for new one-story foundry addition, 115 x 180 ft. Cost over $100,000 with equipment. F. D. Chase, Inc., 307 North Michigan Avenue, Chicago, is architect and engineer.

Crosley Radio Corpn., 1329 Arlington Avenue, Cincinnati, manufacturer of radios and parts, electric refrigerators, etc., has acquired plant of Dirigold Corpn., Kokomo, Ind., now in receivership, and 12-acre tract adjoining, and will remodel for new branch works. Cost over $125,000 with equipment.

WESTERN PA. DIST.

Pittsburgh Plate Glass Co., Grant Building, Pittsburgh, has authorized an additional fund of $500,000 for plant extensions and improvements, making total appropriation of about $5,000,000 approved for such work in 1935. Bids have been asked on general contract for addition to plant at Milwaukee, for paint-manufacturing division, to cost about $300,000 with equipment; Kirchhoff & Rose, 710 North Plankinton Avenue, Milwaukee, are associate architects. Plans have been approved for expansion at plant No. 6, Ford City, Pa., to increase capacity about one-third, cost over $150,000. Work will soon begin on new factory branch, storage and distributing plant at Richmond, Va., to cost about $50,000 with equipment.

E. I. du Pont de Nemours & Co., Inc., du Pont Building, Wilmington, Del., has approved plans for addition to chemical works at Belle, W. Va. Cost over $100,000 with equipment.

Canfield Oil Co., Fourth Avenue, Coraopolis, Pa., with headquarters at Cleveland, has authorized plans for group of three-story buildings, to replace structure recently destroyed by fire at oil refinery, Coraopolis, with loss over $200,000 including machinery. Roy T. Helm is superintendent at plant.

SOUTH ATLANTIC

Jackson Brewing Co., 620 Decatur Street, New Orleans, operating Jax New Orleans Beer Co., Inc., plans new multi-unit brewery at Atlanta, Ga., where site is being secured, to include storage and distributing building, power house and other structures. Cost close to $500,000 with equipment.

Bureau of Yards and Docks, Navy Department, Washington, asks bids until July 10 for one 15-ton revolving gantry crane (Specification 7987) and one 20-ton locomotive crane with clam-shell bucket (Specification 7988), for Charleston, S. C., Navy Yard.

Atlanta Ice & Bottling Co., 247 Courtland Street, N. E., Atlanta, Ga., has let general contract to Flagler Co., Marietta Building, for addition, and remodeling of present buildings for new brewery. Cost about $70,000 with equipment.

Department of Public Works, Winston-Salem, N. C., plans new pumping plant and two elevated steel tanks and towers, with auxiliary booster pumping facilities, for municipal water system. Fund of $140,000 will be arranged.

SOUTHWEST

Laclede Gas Light Co., 1017 Olive Street, St. Louis, has plans for new one-story service, equipment and operating building near company garage, Forest Park Boulevard, 60 x 180 ft., with wing extension, 80 x 120 ft.; foundations will provide for second story later. Cost about $150,000 with equipment. Mauran, Russell & Crowell, Chemical Building, are architects.

Hudson Wire & Iron Works, 1516 East Fifth Place, Tulsa, Okla., has let general

World's Champion Wire Rope Punisher

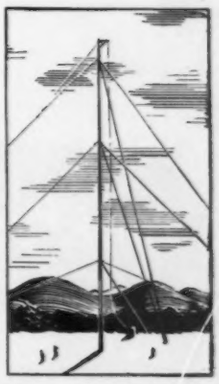
TO MAKE CERTAIN that Roebling Wire Rope will give the user the highest obtainable degree of safe, economical service, Roebling has enlisted the aid of the finest and most complete research, testing and manufacturing facilities. This fatigue machine illustrated is an example. John A. Roebling's Sons Company, Trenton, N. J. Branches in Principal Cities.

DEVELOPED BY ROEBLING FOR WIRE ROPE RESEARCH

What is this huge and complicated Roebling machine... with its maze of pulleys, belting, gears, and what not? It is a pitiless dissector of wire rope characteristics... a machine in which months of wire rope service can be crammed into days... and in which the toughest of conditions can be closely similated.

One of several similar fatigue machines built by Roebling at various times, this unit is the largest, most elaborate, and most highly developed in existence. It is used to study the fatigue qualities of wire rope under various bending and tension conditions.

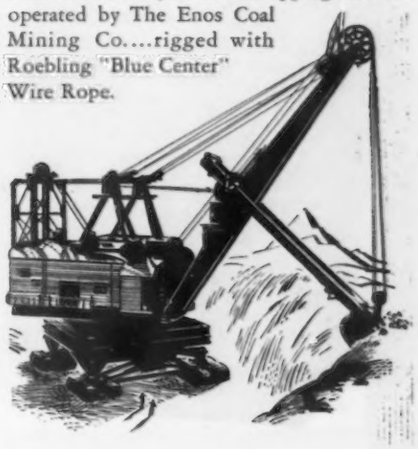
WORLD'S TALLEST TOOTHPICK



It is the new antenna of the Oregonian's radio station KEX... guyed with Roebling Cables... 3200 feet of ½" Galvanized Strand. The rigging job is claimed to be one of the most difficult ever attempted.

18 CUBIC YARDS AT A GULP!

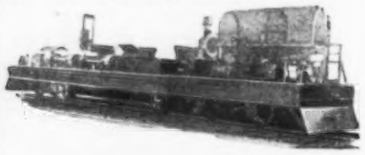
This Giant Bucyrus-Erie stripping shovel operated by The Enos Coal Mining Co....rigged with Roebling "Blue Center" Wire Rope.



ROEBLING ...THE PACEMAKER IN WIRE ROPE DEVELOPMENT

ATLAS CARS

Double Compartment Scale Car with Overhead Operator's Platform. Car provided with Orr Bin Gate Operating Mechanism.



20 Ton Capacity Double Compartment Scale Car for use with Orr type Bin Gates controlled from Operator's Station on Scale Car.

Atlas Products

Gas-Electric and Diesel-Electric Locomotives

Electric Transfer Cars for Blast Furnaces and Steel Plants

Stockhouse Scale Cars for Blast Furnaces

Concentrate and Calcine Cars for Copper Refineries

Automatic and Remote-Controlled Electric Cars

Pushers, Levellers and Door Extractors

Coal Charging Lorries, Coke Guides and Clay Carriers

Atlas Patented Coke Quenching Cars for By-Product Coke Ovens

Atlas Patented Indicating and Recording Scales

Special Cars and Electrically Operated Cars for every conceivable purpose

THE ATLAS CAR & MFG. CO.

Engineers - Manufacturers

1140 Ivanhoe Rd., Cleveland, O.

contract to J. E. Stegall, Tulsa Loan Building, for two one-story additions, 41 x 120 ft. and 20 x 50 ft., to be used in part for storage and distribution. Cost about $25,000 with equipment.

Board of Trustees, Arkansas State College, Jonesboro, Ark., has let general contract to Gamble Construction Co., 620 Chestnut Street, St. Louis, for new engineering building and central power house. Other structures will also be erected. Fund of $450,000 has been secured through Federal aid for entire project. A. N. McAninch, Pyramid Fife Building, Little Rock, Ark., is architect.

Sunnen Products Co., 7900 Manchester Avenue, St. Louis, manufacturer of automotive tools and equipment, has asked bids on general contract for two-story addition, 92 x 120 ft. Cost over $40,000 with equipment.

Common Council, Olney, Tex., asks bids until July 2 for pumping machinery and accessories, elevated steel tank and tower, pipe lines, etc., for municipal water system. Fund of $133,000 has been secured through Federal aid. Joseph E. Ward, Harvey-Snider Building, Wichita Falls, Tex., is consulting engineer.

SOUTH CENTRAL

Director of Purchases, Tennessee Valley Authority, Knoxville, Tenn., asks bids until July 9 for machine shop equipment for use at Wheeler power plant.

H. M. James Machine Works, 1611 De Siard Street, Monroe, La., has let general contract to W. H. Blane, West Monroe, La., for new one-story plant, 60 x 165 ft. Cost about $40,000 with equipment. J. W. Smith & Associates, Ouachita National Bank Building, are architects.

City Council, City Hall, Nashville, Tenn., plans hangars with repair and reconditioning facilities, oil storage and distributing buildings, administration building and other structures in connection with new municipal airport, on which work will begin during summer. Fund of $350,000 has been arranged through Federal aid.

Kent-Taylor Distillery Co., Frankfort, Ky., has plans for multi-story addition for storage and distribution. Cost about $125,000 with equipment. Leslie V. Abbott, 8 Kenwood Village, Louisville, is architect.

Torchlight Block Coal Co., Inc., Torchlight, Ky., plans new tipple at coal mining properties on Levisa Fork. Cost close to $35,000 with machinery.

Ripy Brothers, Lawrenceburg, Ky., Ernest Ripy, head, has approved plans for new distillery on site of former plant at Tyrone, Ky. Cost close to $100,000 with machinery.

MICHIGAN DISTRICT

Industrial Rubber Co., St. Joseph, Mich., manufacturer of mechanical rubber products, has let general contract to M. W. Stock & Sons Construction Co., St. Joseph, for one-story addition, 50 x 250 ft. Cost over $85,000 with equipment.

Daisy Mfg. Co., Plymouth, Mich., manufacturer of air rifles, liquid pistols, parts, etc., has asked bids on general contract for one-story addition, for expansion in press department. Cost close to $40,000 with equipment. Smith, Hinchman & Grylls, Marquette Building, Detroit, are architects and engineers.

State Board of Education, State Capitol, Lansing, Mich., has plans for two new multi-story additions to local State vocational school. Cost over $200,000 with equipment. Bowd & Munson, Lansing, are architects.

Fisher Body Corpn., General Motors Building, Detroit, will begin super-structure at once on one-story addition to press shop at Pontiac, Mich., totaling about 170,000 sq. ft. floor space; installation will include two sets of large turret top presses and battery of other sizes. Cost over $750,000 with machinery. Company has also asked bids on general contract for one-story metal shop addition, 100 x 350 ft. Cost close to $175,000 with equipment. These units are part of general expansion at Pontiac works to cost about $2,000,000 with machinery.

Kalamazoo Stove Co., Kalamazoo, Mich., manufacturer of stoves, ranges, etc., plans one-story addition. Cost over $35,000 with equipment. Leroy & Newlander, Kalamazoo, are architects.

Macklin Co., Jackson, Mich., maker of grinding wheels, has broken ground for one-story addition to plant, increasing capacity 50 per cent and floor space to 70,000 sq. ft. North-Moller Co. is general contractor.

MIDDLE WEST

Air Reduction Sales Co., Inc., 3148 South Homan Avenue, Chicago, with main offices at New York, has let general contract to E. L. Archibald Co., 111 West Washington Street, Chicago, for one and two-story addition, 72 x 250 ft. Cost about $100,000 with equipment. Bernard R. Klekamp, 140 South Dearborn Street, Chicago, is architect.

Paul Gerhardt, 64 West Randolph Street, Chicago, architect and engineer, has plans for new distillery at Ashland, Ky., for company now being organized by Chicago interests. Site has been acquired. Plant will consist of several units, with power house and machine shop. Cost close to $500,000 with equipment.

Quartermaster Depot, 1819 West Pershing Road, Chicago, asks bids until July 10 for 152 compressed air sprayers, with galvanized copper bearing steel tanks, capacity 3¾ to 4-gal. each (Circular 294).

Town Council, La Porte City, Iowa, G. E. Stebbins, clerk, asks bids until July 9 for new municipal electric light and power plant, including two Diesel engine units, direct-connected to two generators, 350-kw. capacity, fuel oil tanks, spray pond and equipment, etc. Fund of $100,000 has been arranged. Young & Stanley, Muscatine, Iowa, are consulting engineers.

Board of Education, Postville, Iowa, has plans for one-story manual training shop, 80 x 135 ft., at local school, with portion reserved for gymnasium. Cost over $35,000 with equipment. Ralston & Ralston, Waterloo Building, Waterloo, Iowa, are architects.

Chicago & North Western Railway Co., St. Paul, Minn., A. G. Barlowe, chief engineer, has asked bids on general contract for new 15-stall engine house with shop and repair facilities, at Itasca, Wis. Cost about $75,000 with equipment.

Southeast Nebraska Public Power District, Beatrice, Neb., has plans for new electrical transmission and distributing lines in rural districts, including power station and service facilities. Fund of $619,000 has been secured through Federal aid. Burns & McDonnell Engineering Co., 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

Chicago Federation of Labor, 666 North Lake Shore Drive, Chicago, plans new Diesel engine power plant for service at radio broadcasting station, Downers Grove, Ill. Cost over $50,000 with machinery. Burns & McDonnell Engineering Co., 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

PACIFIC COAST

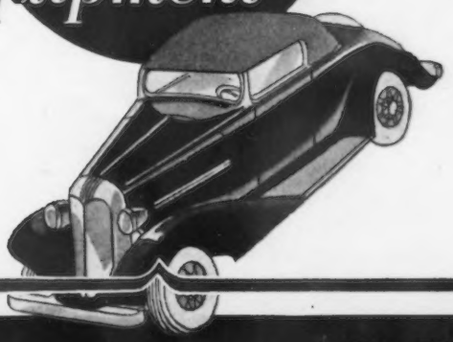
East Bay Fisheries, Inc., 110 Market Street, San Francisco, a subsidiary of F. E. Booth Co., same address, food canner and packer, has leased one-story building, 80 x 125 ft., to be erected at Point San Pablo, Cal., by Parr Terminal Co., 1 Drumm Street, San Francisco, for new canning plant. General contract has been let to P. M. Sanford, Richmond, Cal. Cost about $55,000 with machinery. James J. Walsh, 112 Market Street, San Francisco, is consulting engineer.

Water Department, Pasadena, Cal., plans new one-story machine shop, with automobile service and garage building. Cost about $130,000 with equipment. Appropriation in that amount is being arranged. Samuel B. Morris, Pasadena, is engineer.

Bureau of Supplies and Accounts, Navy

THE MODERN MOTOR CAR···

Illustration of the great diversification of SOUTHWARK *equipment*



BODY
Made on Southwark triple-action presses

CHASSIS
Made on Southwark heavy stamping presses

WHEELS
Made on Southwark heavy stamping presses

MECHANICAL RUBBER PARTS
Made on Southwark steam platen presses

STEERING WHEEL
Made on Southwark steam platen presses

SILENT TIMING GEAR
Made on Southwark steam platen presses

TIRES
Made on Southwark tire heater presses

SAFETY GLASS
Made on Southwark laminated glass presses

DASHBOARD PARTS
Made on Southwark bakelite molding presses

ARM RESTS
Made on Southwark sponge rubber presses

CYLINDER BLOCK, FLYWHEEL
Southwark briquetting machine reclaims cast iron borings for resmelting

ROLLER BEARINGS
High speed hydraulic presses for roller bearing cage manufacture

WINDOW DRAFT INSULATION
Made on Southwark sponge rubber presses

HARDWARE
Made on Southwark die casting machine

SCREW MACHINE PARTS
Brass stock from Southwark extrusion presses

ELECTRICAL INSULATING MATERIAL
Made on Southwark steam platen presses

BRAKE LINING
Made on Southwark molding presses

BALDWIN-SOUTHWARK CORP.
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SOUTHWARK

A Mark of Quality

that every apparatus buyer knows

Apparatus buyers usually are valve buyers, too. So they know the Jenkins "Diamond" trade mark. To them it is a symbol of integrity . . . a trusted guide to efficiency and economy, established by a seventy year old reputation for fine quality, and thousands of pages of advertising.

This famous "Diamond" mark on valves serving your product will contribute definitely to the buyers' impression of "quality throughout". Jenkins Valves provide a selling-point of real significance. And they can be counted on to give the long, trouble-free service that promotes satisfaction with your product. On practically every type of apparatus Jenkins Valves are used as standard equipment to control the flow of steam, hot and cold water, oil, gas, solvents and process liquors.

You will find details on patterns and sizes for every requirement in the Jenkins Catalog. If you need special valves or have a problem of valve selection consult with Jenkins Engineering Advisory Service.

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COLOR INDEX YOUR VALVES *with new Jenkins Colored Valve Wheels. Wherever convenience and fine appearance counts these wheels are sure to attract apparatus buyers. Send for Folder 165 which gives full details about standard and special colors and service markings.*

JENKINS BROS., 80 White St., New York; 510 Main St., Bridgeport, Conn.; 524 Atlantic Ave., Boston; 133 No. Seventh St., Philadelphia; 822 Washington Blvd., Chicago; JENKINS BROS., Limited, Montreal; London, Eng.

Department, Washington, asks bids until July 5 for ball bearings (Schedule 5373); until July 9, 10 portable oxy-acetylene cutting and welding outfits (Schedule 5407), for Mare Island Navy Yard.

California Grape Products Co., 85 Second Street, San Francisco, plans new winery at vineyard property, Trocha, Cal., with storage and distributing units. Cost over $175,000 with equipment. Horace O. Lanza is president.

Yakima Brewing Co., Selah, Wash., has taken over former packing plant and will remodel for new brewery. Cost over $60,000 with machinery. C. F. Guenther is superintendent, in charge.

United States Engineer Office, Customhouse, Portland, asks bids until July 10 for lock-operating equipment for Bonneville power project.

Steelform Contracting Co., 131 Perry Street, San Francisco, has plans for new one and two-story storage and distributing plant. Cost about $30,000 with equipment. L. H. Nishkian, 525 Market Street, is engineer.

General Petroleum Corpn., Havana and Sprague Streets, Spokane, Wash., plans addition to bulk oil storage and distributing plant. Cost about $25,000 with steel tanks and equipment.

◀ FOREIGN ▶

Kyushu Soda Co., Ltd., Tokyo, Japan, recently organized as a subsidiary of Japan Soda Co., Ltd., with capital of 10,000,000 yen (about $2,900,000), plans new multi-unit plant at Karita, near Kokuru, Kyushu, for production of industrial chemicals, oils and paints. Cost over $500,000 with machinery.

Romitex, S. A., Timisoara, Rumania, processed cotton manufacturer, has approved plans for new spinning mill, with initial installation of about 12,000 spindles and accessory equipment. A dye and finishing works will also be built. Entire project will cost over $400,000 with machinery and is scheduled for completion by end of year.

Thor Washing Machine Co., Canada, Ltd., 100 Sterling Road, Toronto, plans early occupancy of large portion of former local plant of Crosse & Blackwell, Ltd., at Fleet and Bathurst Streets, recently acquired, where increased capacity will be carried out. Building improvements are under way.

Wage Earner Vacations With Pay Analyzed

A THOROUGH analysis of vacations with pay for wage earners is contained in No. 215 of the National Industrial Conference Board Studies, published by the board at 247 Park Avenue, New York. The study was made because of the great renewal of interest in this subject recently.

A similar analysis had been made in 1931 and companies which had reported such plans in that year were asked whether or not they had been continued through the depression. In addition, information was sought from companies which had instituted vacation plans since 1931.

It was discovered that half the vacation plans covering wage earners which were operating in 1931 continued in force throughout the depression and that 10 of the 19 plans adopted since 1930 were started in 1934.

Establish Plant In South Africa

A GROUP of 25 McKinnon-Columbus Chain Corpn. executives sailed June 7 for London on the first leg of their journey to Veerenging, near Johannesburg, South Africa, where complete modern buildings await their arrival to install the latest electric welding machinery. The group is under the direction of F. E. Stahl, manager of plants for McKinnon-Columbus Chain, Ltd., of St. Catharines, Ont., the Columbus-McKinnon Chain Corpn. and the Chisholm-Moore Hoist Corpn., Tonawanda, N. Y.

The new South African plant, to be known as McKinnon Chain-South Africa-Ltd., will be devoted to the manufacture of chain specialties of all kinds, with special attention to industrial chain and chain hoists for use in gold and diamond mines of the Transvaal and coal mines in Rhodesia. Farming and marine chain will be handled from a branch office to be established at Cape Town.

The LEADING
REFRIGERATOR COMPANIES
Know Their Enameling Iron
PORCELAIN ENAMEL ON ARMCO INGOT IRON
This is the famous label that hundreds of manufacturers use to help speed sales in retail stores. You can, too. Write us.

★ There is no secret to it—the leaders of household and commercial refrigeration regularly use Armco Enameling Iron. It cuts costs and helps them turn out better, more saleable products. ★ Their experience shows that these constantly-improved enameling iron sheets are consistently flat—an obvious advantage. Sagging is reduced to a minimum, while such common troubles as fishscaling, reboiling and black-specking are all but eliminated. Coats go on smooth and have plenty of sales-appeal. ★ But the one thing that Armco Enameling Iron does best of all is hold the porcelain enamel in a dogged, vise-like grip. It ranks foremost in adherence; and you know what this means in terms of profit and satisfied customers. ★ Remember, you pay no more for Armco Enameling Iron, and you can get it quickly. Consult us about your needs. We shall be glad to work with you with all our resources.

THE AMERICAN ROLLING MILL COMPANY
Middletown, Ohio

JONES & LAUGHLIN STEEL CORPORATION
AMERICAN IRON AND STEEL WORKS
PITTSBURGH, PENNSYLVANIA

Waste Elimination and Economies Said To Lead to Depression Unemployment

THE basic reason for the increase in productivity during a period of business depression is not mechanization of industry, but rather the drastic elimination of all waste, and rigid economies all along the line of production and distribution, practiced by industry as a whole as a means of maintaining markets in a period of declining demand, according to another in the series of studies made by the National Industrial Conference Board for the National Machine Tool Builders' Association.

The conference board is making a survey to determine the extent of mechanization in industry, machine production and related facts.

"During the current business depression there has been a large increase in the output of industry per worker employed," the board reports. "It is a serious mistake, however, to assume that the efficiency of labor and capital would remain at this high level in the event of a genuine business revival which would lead to re-employment of less efficient workers and which would relieve management from the necessity of rigid economizing.

"Along with the vast mechanization of industry the number of workers during the period 1899 to 1929 increased 110 per cent, while hours of work per week were reduced only 15 per cent. Despite the vast increase in the output per man-hour and a relatively small reduction in hours, the percentage of unemployment was smaller during the post-war period from 1923 to 1929 than in 1899 or 1904. While it is true that the decrease in hours may have been to some extent responsible for maintaining the volume of employment, this decrease is small compared to the increase in the productivity of industry.

"During this period, increased productivity of industry per man employed was reflected primarily in a great improvement in the standard of living of the entire population.

"Among a multitude of controversial economic theories which attempt to explain the causes for business fluctuations, a prominent place is occupied by the theory that technological progress is the cause. Other theories attribute cyclical fluctuations to such causes as: the spots in the sun; agriculture; the lack or over-abundance of money; domestic trade; international trade; capital; interest; labor; human behaviorism; over-production; under-production; over-capitalization; under-consumption; concentration of wealth; concentration of income; and many other supposed causes. It would be as fallacious to evaluate these theories individually as to state dogmatically that any one or all are wrong or right.

"The theorists who accuse technological progress of being the root of all evil maintain that over-capitalization and displacement of labor by machinery has brought about a lack of equilibrium between consuming and producing powers. The tabulation below indicates that up to 1929 this was not the case because in 1899 and 1904, for example, there was relatively more unemployment than, on the average, during the decade of the '20s. This is especially noteworthy in view of the fact that every man hour of production in manufacturing produced twice as much as in 1929 as it did 30 years prior to that date and was accompanied by a decrease in weekly hours of only about 15 per cent during this period.

"The effect of this increase in productive power was an enormous increase in the standard of living from 1899 to 1929. Per capita production of manufactured goods developed greatly during these years, and American manufacturing industries were able to provide every man, woman and child in this country with twice as many goods in 1929 as they did at the beginning of the twentieth century."

POPULATION, MANUFACTURING PRODUCTION, AND PRODUCTION PER CAPITA, 1899-1929

Index Numbers, 1899 = 100

	Total Population	Production of Manufacturing	Per Capita Production of Manufacturing
1899	100	100	100
1909	121	159	131
1919	140	214	152
1929	162	316	194

THE SCALE OF A *Thousand Uses*

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CONTROL PROCESSING...INSURE QUALITY...GUARD STANDARDS ...SAVE MONEY

There is a way to stop the leaks that run up costs . . . the unchecked shipping weights . . . the unverified costs of charging furnaces and smelters . . . the inaccuracies of pencilled notations made hurriedly by untrained employees. It's Fairbanks scale accuracy plus mechanical printing.

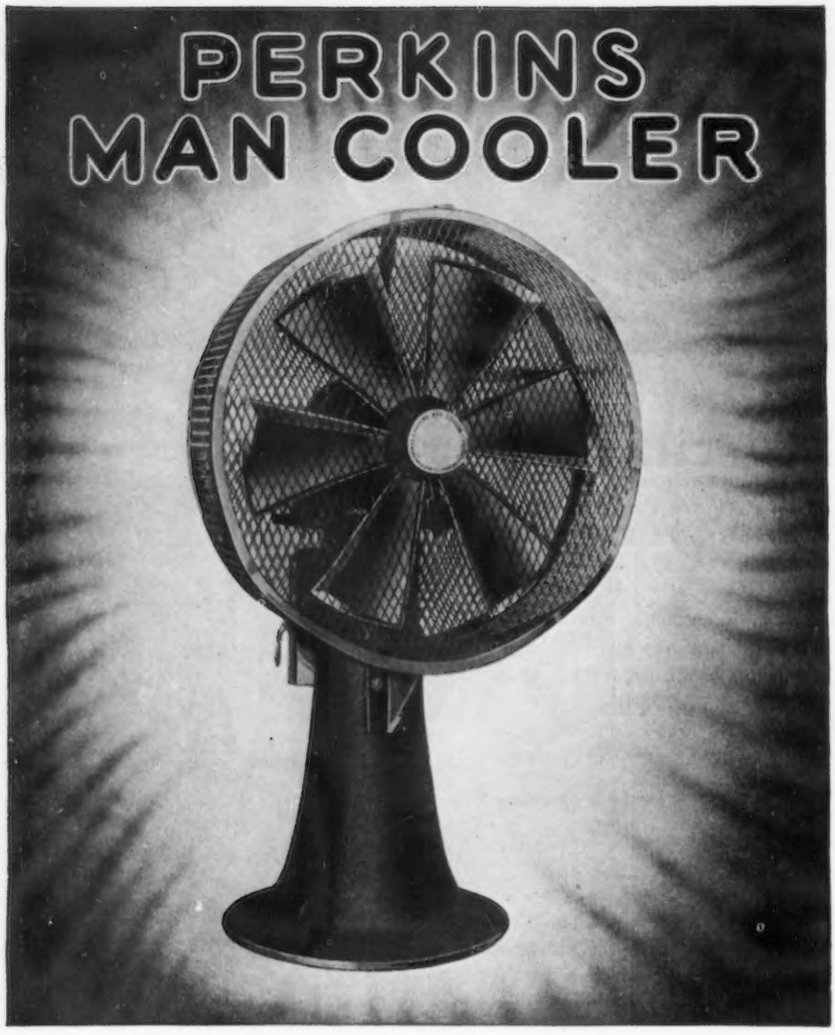
For controlling flow of materials—for payment of men on a tonnage basis — for providing accurate, printed records of each job—for checking, receiving and conserving raw materials —for batching and mixing operations, Fairbanks Scales equipped with mechanical printers keep the accurate, indisputable records that help to cut both operation and production costs.

It costs nothing to get the facts on how Fairbanks mechanical printers can serve you by providing the automatically printed records that point the way toward increased efficiency and lowered costs. For full information, write Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill. And 40 principal cities—a service station at each house.

Fairbanks Scales

PREFERRED THE WORLD OVER

6350-SA 40.16



PERKINS MAN COOLER blows heat away. Because cold air is not introduced from the outside, its invigorating breeze does not chill. It produces refreshing recirculation of air of the same temperature in which the men are working.

B. F. PERKINS & SON, Inc., HOLYOKE, MASS.
ENGINEERS AND MANUFACTURERS

Hot Strip Steel Rolled On Steckel-Type Mill

(CONTINUED FROM PAGE 17)

low the heat requirements of the furnace. The quantity of air and oil are maintained in correct relation although the quantity of fuel is varied. This procedure eliminates erratic operation commonly found where all control of air and oil is manually accomplished by the heater.

Throughout its length the hearth of the furnace is level. For a distance of approximately 20 ft. from the charging end the hearth consists of heavy water-cooled skid rails, the material traveling on these rails. The remaining 11 ft. of the hearth consists of plastic chrome ore rammed in place to form a hearth of high heat conductivity and highly resistant to abrasion. The roof of the furnace is of the American suspended type which readily permits replacement of any portion of the arch, should repairs be necessary.

There are four working openings or doors along the side of the furnace. At the discharge end are two larger doors directly opposite each other. These doors are provided with electric thrusters arranged for push button operation by the operator who discharges the slabs from the furnace. The furnace is inclosed on the sides, bottom and end by heavy steel binding, reinforced with structural buckstays.

Recent production runs on the new McLouth mill have yielded an output of 15 net tons per hr. of 12-gage strip 12 in. wide. This is accomplished with a plant investment of about $500,000 and in a floor space of about 75,000 sq. ft., including pickling and other equipment. The mill is capable of making hot strip steel from 5 to 16 in. wide and from ¼-in. to 16-gage in thickness.

The present plant of the McLouth company occupies half of a three-acre site on Livernois Avenue in Detroit. It is served by two spur sidings of the Michigan Central Railroad, with tracks running directly into the plant. Equipment provides facilities for pickling, straightening and cutting to length of strip to meet special requirements. The company has operated, for the last 13 years, a steel warehouse business in Detroit under the name of the Consolidated Steel Corpn. Its recent entry into steel manufacturing has been privately financed without outside capital. Donald B. McLouth is president, L. E. Moultane, vice-president and secretary, and L. H. McLouth, treasurer.

McLouth's new mill was built by the Mackintosh-Hemphill Co., Pittsburgh. The slab heating furnace was designed and built by the Electric Furnace Co., Salem, Ohio. A 1000-lb. water hydraulic unit for removing scale was installed by the Worthington Pump & Machinery Corpn. Electrical equipment was designed and installed by the General Electric Co.

Mesta

BACKING UP ROLLS

HEAT TREATED SPECIAL ALLOY STEEL,

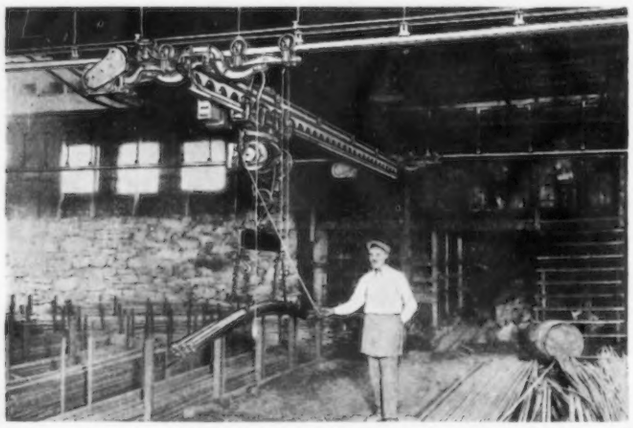
Are giving exceptional service on Continuous Hot Strip and Cold Mills

MESTA MACHINE COMPANY · PITTSBURGH

MOTOR OPERATED CRANES AND TRANSFER BRIDGES

THERE is a type listed in the Cleveland Tramrail Catalog to suit most every condition encountered.

Two runways for spans up to 30 feet, multiple runways for the longer spans. Floor and Cab Controlled.



A Cleveland Tramrail motor operated transfer bridge with a hand propelled carrier and electric hoist. Both being push button controlled, give one operator control of all motions of the bridge andcarrier.

Consult your 'phone directory under "Cleveland Tramrail"

CLEVELAND TRAMRAIL

Hand or Electric
Overhead Materials
Transportation Equipment

DIVISION OF
THE CLEVELAND CRANE & ENGINEERING CO.
WICKLIFFE OHIO

The Role of Metals

(CONTINUED FROM PAGE 20)

storehouses. They roll only a very small percentage to 6 to 10 per cent of their life and in the meantime are exposed to the rough usage of loading, unloading and handling.

Accordingly, the problem is one of increased durability with little or no increase of weight, and certainly at a low first cost. Here, the newer alloyed steels offer promise. Less favorable, however, is the hope of great saving through improved design, for freight cars already represent a pretty efficient use of the material employed. They average about one pound of car to three pounds of load, as contrasted to passenger coaches which rate some 13 or 14 lb. of car for every pound of passenger.

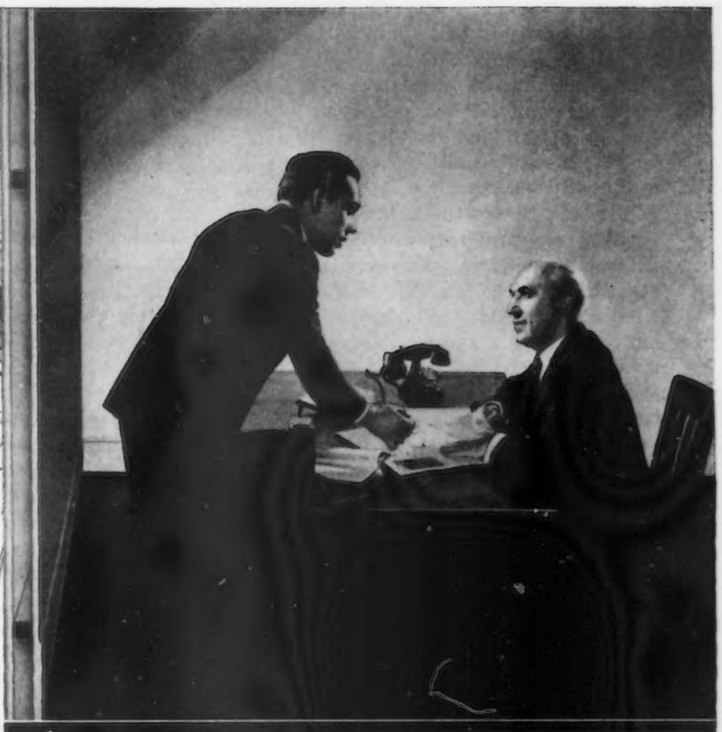
In between these extremes of high-speed, streamlined trains and freight cars, lies a large field of rolling equipment where the economic answers are not only more difficult but where the relation between first cost and expectant performance leave an uncertain basis from which to proceed. The issue will probably be drawn on the question of conventional-type passenger coaches intended for use behind existing locomotive. The full significance of weight, here, has not yet been fully appreciated, but it will be.

Evaluation of Materials Involves Many Considerations

When metals were evaluated by that trinity of physical properties known as tensile strength, elastic limit and elongation, things were quite simple but insufficient. Since then, impact, fatigue and other characteristics have been given comparative values. In fact, the items listed under the heading of "physical properties" are today so extensive as to confuse rather than to facilitate comparison.

Far more significant, but by the same token, far more difficult to reduce to formula, is the question of comparative application. Theoretically, one can build just as lightly and just as strongly in spruce, aluminum alloy, or stainless steel. Practically, there may be very decided reasons for the preference of one over the other two. In any case, the design will be quite different.

These three dissimilar materials



SOME OF THE MEN YOU NEVER SEE

HE is not just an American Steel & Wire Company sales representative who calls upon you. Rather he is a symbol of the army of men you never see. They are hundreds of American Steel & Wire Company technicians and metallurgists who are continually working and planning the best methods of meeting your production, material and specification needs. Many are young, keen and quick-thinking. Others, older and more experienced provide a tempering balance. Together they make up the best reason why many industries depend on American Quality Cold Rolled Strip Steel to fill their material requirements and solve their production problems. American Quality Cold Rolled Strip Steel can be delivered to you exactly at the time you want it, to your own standing specifications—in coils or cut lengths, in all widths, tempers, thicknesses, gauges and finishes. Drop us a line today. Tell us your problems and get our facts and figures.

American QUALITY Steel & Wire Company

COLD ROLLED STRIP STEEL

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vary primarily in bulk and method of joining. Bulk makes for sectional stability in any structural member, while the efficiency of joining determines the degree to which these members may be evaluated in a complete structure. While bulk favors the lightest material, the problem of joining favors the heaviest. However, the stabilizing effect of bulk can be simulated through the design of built-up sections and, if joining is simple and effective, both advantages stand combined in the one material, namely steel.

Translated into equivalent structures, we find respectively a wooden plank on edge, an aluminum I-beam and a fabricated box girder of steel. The attachment of these into a structure is again respectively by bolts, rivets or welding. Comparative efficiencies of these joints as related to the members themselves approximate some 30 per cent, 60 per cent and 80 per cent.

The joining of materials is among the oldest crafts and is still a problem to tax our every ingenuity. Not until very recent years has any new thought been introduced and that relates not so much to joining as it does to making the material pieces continuous by welding. Of course, fire welding is an ancient art, but welding in place rather than at the forge is a new development. The moment that welding becomes portable, it is in a position to compete with riveting. However, welding, unlike riveting, has a heat effect on the metal and this is to be reckoned with. Since heat effect is inherent, the welding cannot be accommodated to the material. The material must be accommodated to the welding. Some metals are, therefore, not adaptable to the process at all, while others show varying degrees of adaptability. This characteristic is apt to be far more determining today than other physical properties. In other words, one selects from among the weldable metals that which has the highest physicals.

Strangely enough it is cold-rolled stainless steel again which combines the greatest strength, the greatest toughness and the highest degree of weldability. It is not, however, generally weldable. Arc or gas welding may impair its metallurgy and will certainly destroy all beneficial effect of cold working. The "shotweld" process alone gives an efficient weld without injurious effect to either metallurgy or cold rolling. In fact both metal and welding process appear to be complementary to each other.

Recorder Tests Weld as It Is Made

As applied in practice, the shotweld process requires no skill, is cheap and is uniform of performance. Companion to it is the recorder which not only records the heat units entering into each weld, but gives audible warning of every weld above or below the normal. This is believed to be the only instrument ever to give automatically the answer to the question as to whether a weld is good or not.

The development in structural use of stainless steel and the shotwell process dates back over six years. Its first reduction to practice was in connection with airplane parts. A complete amphibian plane was built and tested both here and abroad. Then, even before the railroads became weight-conscious, a 40-passenger rail car was built. This weighed complete with power plant, only 15,000 lb. Since then, the development has progressed in accordance with the advancement of railway requirement. It now seems to have stabilized in the Zephyr-type train.

Stainless steel is a generic term and covers a number of alloys of widely different characterictics. Structurally, interest centers about the one alloy known as 18-8. When cold-rolled to 150,000 lb. per square inch ultimate, it reaches the happiest combination of strength, yield point and workability.

Aluminum Alloys and Low-Alloy Steels Command Attention

Almost simultaneous with the development of the stainless steel railway car, has been a similar endeavor using aluminum alloys. As previously stated, these alloys and high-tensile steel balance out on a purely strength-weight consideration. Where differences occur in the final result, these can be attributed to differences of design, aim and technique of application. The bulkiness of the lighter alloys invites skin-stressed car structures, while with thin steel, the tendency is toward trussed members. A further appeal in the use of aluminum is that substantial weight reduction is had without departure from conventionally rolled sections, and assembly is still by rivets. In other words, shop practice need not be greatly disturbed.

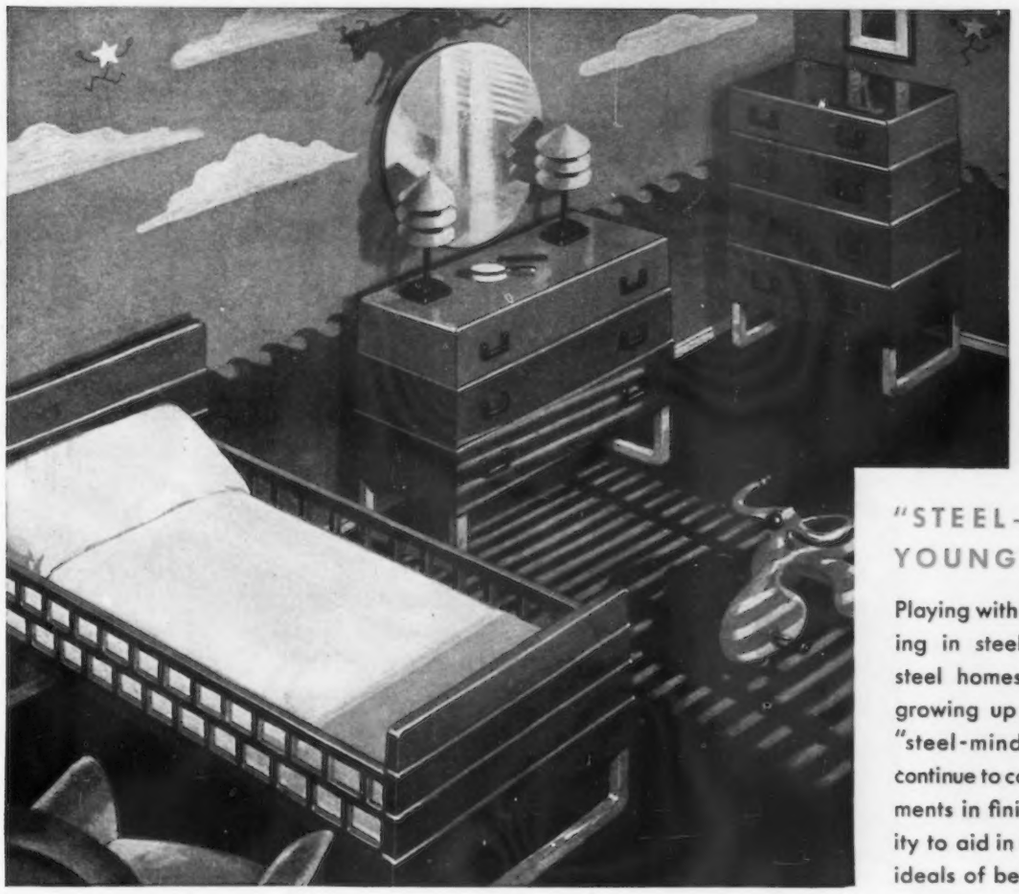
Regardless, however, of whether or not the aluminum alloys are used for the basic car structure, these do play an important part in all schedules for weight reduction. The amount of aluminum used in train, appointments and apparatus forms an amazing proportion of the total equipment load. But, here, again, enters the question of base price.

Out of this cost argument has come a series of low-alloy steels which, while falling far short of the properties of stainless, still represent a considerable advancement over plain carbon steel. Most significant among the properties of these newer steels is an elastic limit of some 54,000 lb. per square inch and a good degree of weldability. These steels have already enjoyed a wide application in the railway equipment field. The technique of their use has introduced new problems into the car shops. This is inevitable, for one does not turn lightly from riveting to welding. The highly localized heat is apt to provoke warping or other disturbances and the training of good welders is still another problem. All of these problems become increasingly more difficult as the gage becomes thinner.

However, regardless of the means, the demand for reduced weight of rolling equipment is clearly defined. With that demand will come a better appreciation of the economic role of metals. We will never know the toll which excess weight has enacted in the past, but we will know what lightweight construction does promise for the future.

Originally, desire lagged for lack of the materials of expression and progress was slow. Today, however, the metallurgists must find keen satisfaction in not only having met, but in actually having anticipated every new demand. In fact, so well has the metallurgist done, that he finds industry somewhat confused by too wide a choice of materials. This leads to discussion, prejudice and often arbitrary decisions, but out of it all will come a betterment. The role of metals will again have been that of economic rescue.

Your Problems Solved With Inland Cold Rolled Sheets



"STEEL-MINDED" YOUNG AMERICA

Playing with steel toys, sleeping in steel beds, living in steel homes, Americans are growing up more and more "steel-minded". Inland will continue to contribute improvements in finish and workability to aid in carrying out new ideals of beauty and quality.

YOUR problems of finish, of draw and fabrication can be solved with Inland Cold Rolled Sheets. They are made in grades with characteristics meeting all requirements. Inland's advanced equipment and experience in making and applying sheet steel is at your service. INLAND STEEL COMPANY, 38 South Dearborn Street, Chicago, Illinois.

Sheets Strip Tin Plate
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Rails Track Accessories
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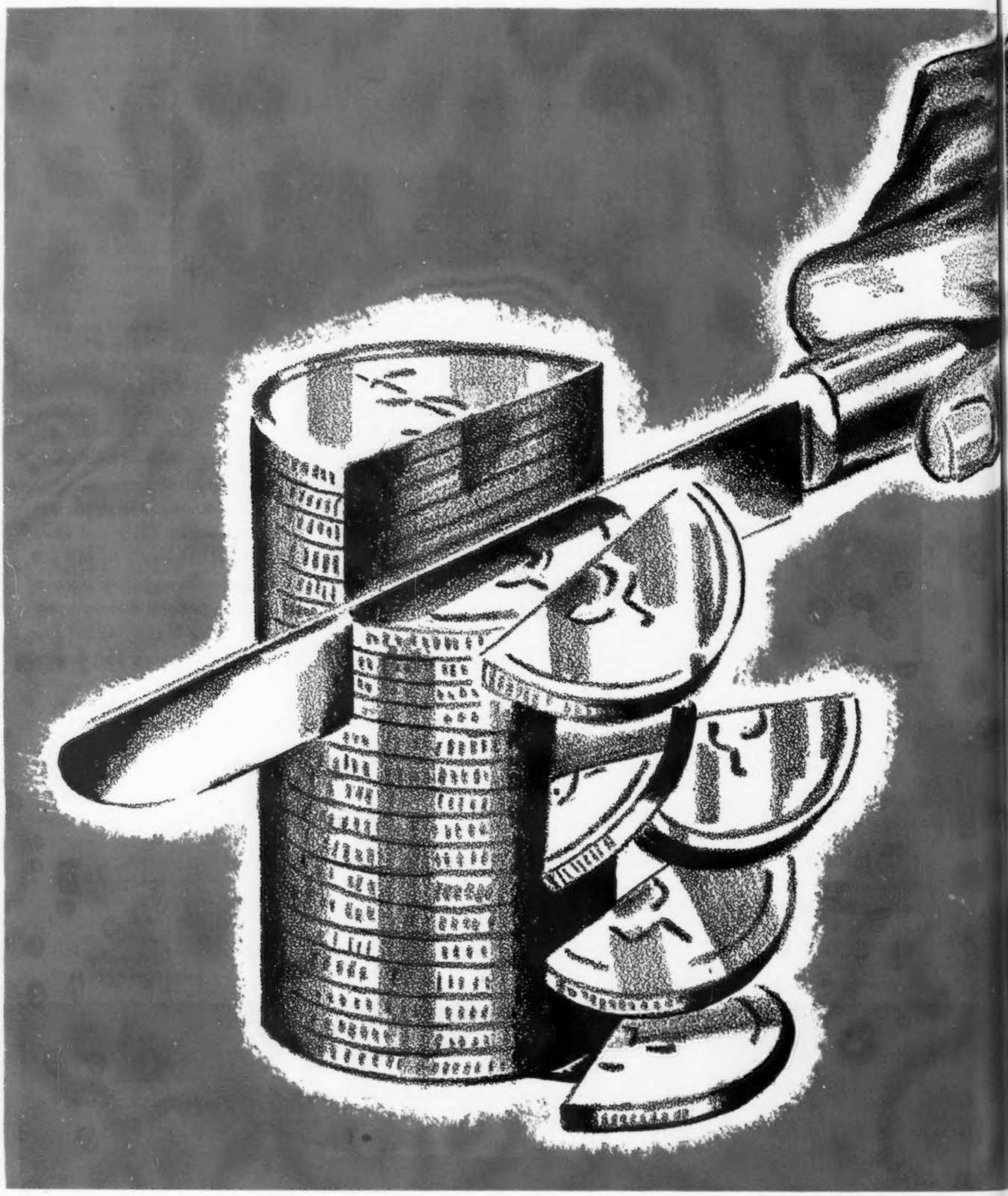
"We Sliced 53¢ off Every



RY LUBRICATING DOLLAR . . . . .

With this Tycol Grease"

Grease formerly used in this rolling mill had to be pumped through the force-feed system in such quantities as to cause overflow from the bearings onto housings and floor. Even then the protective lubrication was none too good. They switched to Tycol High Pressure Grease—here's what happened:

First of all the piston stroke of the force-feed system was cut in half. An immediate saving in lubricant of 50% resulted. The waste was stopped abruptly and additional savings were effected by making it possible to reduce maintenance charges and clean up the floor of the mill.

This experience is typical of the results obtained with Tycol greases, which contain the maximum amount of lubricant for a given consistency. Compounded especially for roll-neck service, they contain only the finest ingredients. Constantly uniform in character, these greases yield lubrication costs per ton that remain economically constant.

Let Tide Water engineers survey your needs and recommend the proper grease to assure maximum lubricating economy.

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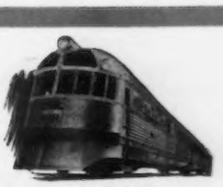
TIDE WATER Roll Neck GREASES

THERE IS A COMPLETE LINE OF TYCOL LUBRICANTS SCIENTIFICALLY ENGINEERED FOR EVERY INDUSTRIAL USE

INDUSTRIAL TYCOL OILS-GREASES



The Flying Yankee, Crack Train of the Boston and Maine and Maine Central Railroad, is Lubricated with

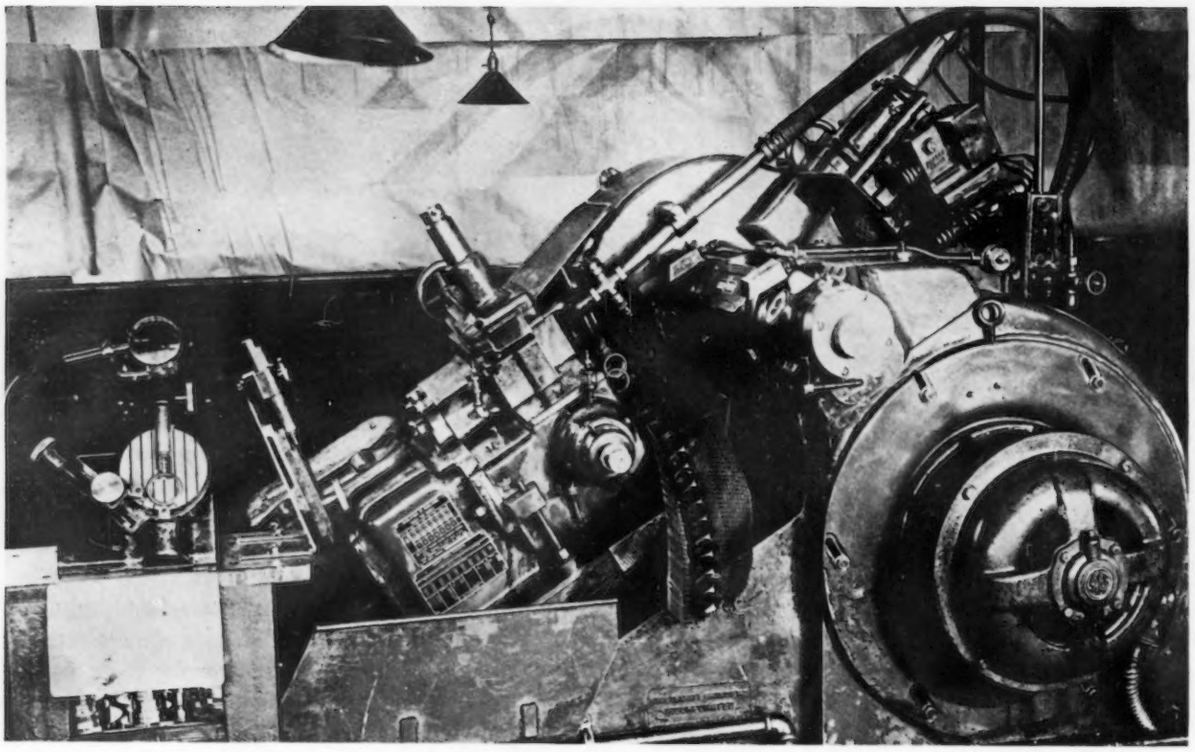
VEEDOL

a Product of the Tide Water Oil Company

MACKLIN

CENTERLESS GRINDING

WHEELS



Here is graphically shown Macklin Wheels being efficiently used on a Cincinnati Centerless Grinder in a large ball bearing factory. As shown above Macklin Centerless Grinding Wheels are grinding the outside diameter of ball bearing races removing .015″ of stock and holding to limits of .0004″. Macklin engineers will be glad to tell about the many economical uses of Macklin Wheels.

MACKLIN COMPANY

Manufacturers of GRINDING WHEELS—JACKSON, MICHIGAN, U. S. A.

Sales Offices:—Chicago—New York—Detroit—Pittsburgh—Cleveland—Cincinnati—Milwaukee

FOR OPERATOR, LOAD AND TRUCK

Elwell-Parker Customers:

Each time you purchase Elwell-Parkers, your money also buys *safety* in every inch of wheelbase, every pound of material, every instant of operation. For example:

1—***Truck cannot move*** unless operator is in position: both pedals spring upward instantly when he steps off platform. One automatically sets the brakes; the other disconnects the controller from source of power.

2—***To increase operator's comfort*** and guard against his loss of time from the job, both pedals are fitted with pads of resilient rubber which absorb vibration while traversing uneven runways.

3—***Control Handle*** returns to "off" position the moment operator's hand is removed.

4—***When ascending ramp*** load first, operator can stop and start at will, by applying power to motor and releasing brake gradually.

5—***Gangplanks*** between ships and docks can be traversed safely with Truck under load, regardless of tide conditions and resulting variation in levels.

6—***Fire hazard greatly reduced.*** Motor Controllers and Wiring on Elwell-Parker Electric and Gas-Electric Trucks, Tractors and Cranes have been approved by ***Underwriters' Laboratories.***

Your own Safety Department will cordially approve Elwell-Parker's outstanding contribution to the protection of men, load and the Trucks themselves. Many safety features, as well as operating advantages, are exclusive with Elwell-Parker.

Why not *repeat* on your original wise selection by installing *New* Elwell-Parkers for your own modernized methods of production? An Engineer will gladly call. The Elwell-Parker Electric Company, 4225 St. Clair Ave., Cleveland, Ohio.

New **ELWELL·PARKER** *Fork trucks*

ESTABLISHED 1893 • BUILDING INDUSTRIAL POWER TRUCKS SINCE 1906

Do you know WIRE FORMING AND WELDING

Eleven Sizes
Automatic Four Slide Machines

Perhaps we can supply a machine which combines wire forming and welding in one operation and do it to your advantage.

Over 60 years of experience designing and building automatic machinery to produce or finish small articles of wire, ribbon metal, castings, forgings, etc., is at your disposal.

AUTOMATIC BAIRD MACHINE CO. BRIDGEPORT, CONN.

"Ask Baird About It"

THE BAIRD MACHINE CO., BRIDGEPORT, CONN.

METAL STAMPINGS

Since 1896 the Crosby plant has been devoted, exclusively, to designing and producing Sheet Metal Stampings. Avail yourself of this experience. Send us your next stamping problem and watch results.

Manufacturers of "IDEAL" TROLLEY WHEELS

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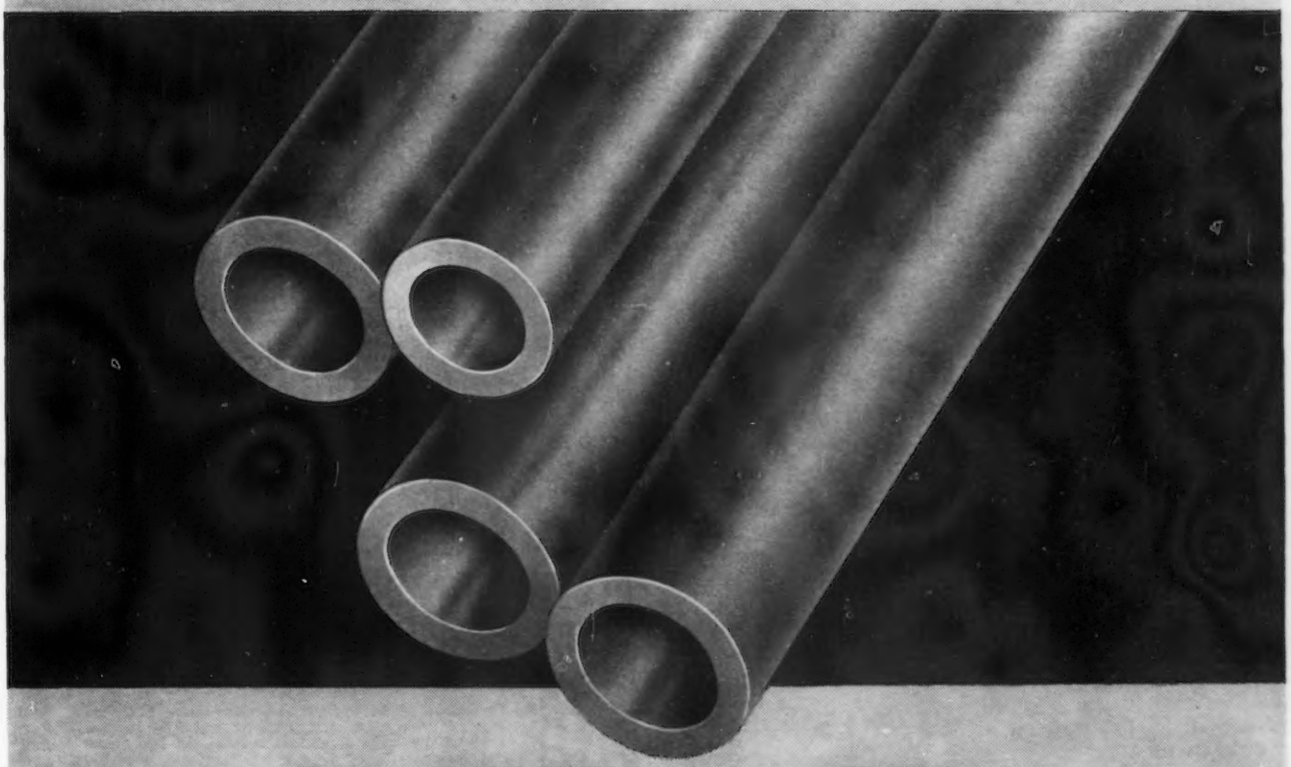


BUILD WITH
Pittsburgh Seamless
BOILER TUBES

Build into power equipment the dependability that means long service and superior safety. Pittsburgh Seamless Boiler Tubes will give you that assurance. Service records over many years have demonstrated their ability to withstand stress and give exceptional performance.

Pittsburgh P Products

PITTSBURGH STEEL COMPANY

PITTSBURGH, PA.

New York Detroit Chicago
St. Louis Tulsa Houston
San Francisco
Los Angeles

JUST BETWEEN US TWO

Cobb Comes a Cropper

HUMPHREY COBB, author of the phenomenonally successful war novel, "Paths of Glory," thinks Tiffany advertising is perfect and most others rank from so-so down to awful. You know the Tiffany formula—"Tiffany & Co., Silverware," and nothing more.

Mr. Cobb was in the advertising business once himself. He said he didn't like it and didn't get along very well in it. And no wonder. The Tiffany style is very wasteful, like running a six-cylinder motor with only three spark plugs Name publicity is worth something, but unless you sa something that will make the reader want the product, you are wasting half the power of the space.

Would the refractory manufacturer, whose full page ad in a recent issue paid for itself over and over again in direct returns, have obtained those returns if he had advertised, "The Blank Co., Refractories"?

Jimmy Durante's opinion of the Fletcher-Reyburn holding company bill would be interesting but not important.

Mighty Minds

WE were annoyed no end at the tone of the letters offering solutions to the Jones-Smith-Robinson problem. After struggling with it fruitlessly every night for a week, we were in no mood to get the right answer with the smug observation, "It took me ten minutes," as if Einstein had been asked the square root of 16 and double it.

We hope the mighty minds will stub their cerebral toes on this one:

A, B and C meet in a hotel wash room, and all burst into laughter. A and B have smudges on their faces. C is unmarked. B instantly walks to the wash stand to wash his face. How did B know his face was smudged?

Wolf, Wolf

MAYBE the Oberleutnant is smarter than we thought he was. He usually is and that is probably how he got to be Oberleutnant. As he is not especially articulate, we have to figure out for ourselves his reasoning in this matter of bragging.

We are beginning to see a little sense in it. Perhaps he reasons that if you brag all over the lot, when you have something really important to brag about, no one will pay much attention to you.

He winced years ago when the slogan, "The World's Greatest Industrial Paper," was concocted. He looked pained even when the modest line, "The Most Widely Quoted Business Paper," sprang full-fledged from the brow of some forgotten Jove.

Neither is susceptible to exact proof, and henceforth neither will receive aid or comfort here, nor will we promote any other boast that can't be proved by arithmetic.

Hooray for Us

BUT we will, when opportunity offers, call your attention to such facts as this one: that in May The Iron Age carried 307 pages of advertising, a gain of 15.4 per cent over the previous May; that this gain, whether calculated in number of pages or in percentage, exceeded that of any other of the major metal-working papers. We took the figures from the table on page 56 of the June *Industrial Marketing*.

The average gain for industrial papers as a whole was 9.8 per cent, so your favorite journal is sitting pretty.

Honi Soit

THE inelegant expression "back side" seems to be getting quite a play in the trade press of late. It even crept into the chaste columns of this organ of propriety—"The pads on the back side of the tailstock, etc."

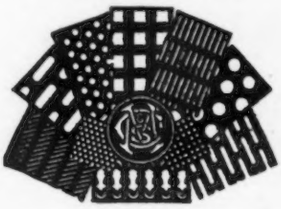
We were assured that the word "side" is necessary to insure preciseness, but hope it won't be necessary very often as it would be a sorry day for us if readers were afraid to leave copies on the library table, where they might be seen by younger members of the family. —A.H.D.

MUNDT
PERFORATED METALS

Large stocks of all metals always in hand ready to punch for any arrangement of perforations.

Sixty-one years of manufacturing perforated metals for every conceivable purpose assures satisfaction.

Write for Catalog of Patterns



TIN, STEEL, COPPER, ALUMINUM, BRONZE, BRASS, ZINC, ANY METAL, ANY PURPOSE

CHARLES MUNDT & SONS
59 FAIRMOUNT AVE., JERSEY CITY, N. J.

HENDRICK
PERFORATED METALS

Perforated Metal Screens in steel, bronze, Stainless Steel, Monel, Aluminum, Everdur and other metals. Perforated Grilles in various metals and many special designs.
Mitco Open Steel Flooring, Mitco Shur-Site Treads, Mitco Armogrids; also elevator buckets, conveyor troughs and products fabricated from heavy plate. Write for catalog.

HENDRICK MFG. CO.
37 Dundaff Street Carbondale, Pa.
Baltimore Birmingham Boston
Cincinnati Cleveland Detroit Hazleton
New York Philadelphia Pittsburgh

GET IN THE HABIT

of reading and using the classified sections—they are full of opportunities.

Cone 4-Spindle Automatics

Are economical and accurate producers of screw machine parts up to 6″ diameter, 7″ milling length. They cut costs, increase production, boost profits.

Write for particulars

CONE AUTOMATIC MACHINE CO., Inc.
WINDSOR, VERMONT

REPRESENTATIVES:

Detroit: J. C. Austerberry's Sons, 634 E. Congress St., Detroit, Mich.
Chicago: John H. Glover, 2127 North Sayre Ave., Chicago, Ill.
Ohio: S. B. Martin, 1077 Erie Cliff Drive, Lakewood, Ohio.
New England: Potter & Johnston Machine Co., Pawtucket, R. I.
Indiana: G. A. Richey, Chamber of Commerce Bldg., Indianapolis, Ind.
New York State: Syracuse Supply Co., Syracuse, N. Y.; also Rochester, N. Y.
Pennsylvania: Arch Machinery Co., 1005 Park Bldg., Pittsburgh, Pa.
Philadelphia: Lloyd & Arms, Inc., 133 South 36th St., Philadelphia, Pa.
California: C. F. Bulotti Machinery Co., 829-831 Folsom St., San Francisco, Calif.

ARMSTRONG TOOL HOLDERS

Save All Forging, 70% Grinding and 90% High Speed Steel. Over 100 sizes and shapes—holders for every operation on lathes, planers, slotters and shapers.

Write for Catalog B-35

Armstrong Bros. Tool Co.
"The Tool Holder People"
309 N. Francisco Ave.
CHICAGO, U. S. A.

Famous for quality of threads they produce, long life of chasers and all-around dependability.

Following literature available:
Bulletin on H & G General Purpose Die Heads.
Bulletin on new Insert Chaser Type of Die Head.
Bulletin on H & G Threading Machines.

The Eastern Machine Screw Corp.
21-41 Barclay Street, New Haven, Conn.
Los Angeles: A. C. Behringer, 312-316 Commercial St., Los Angeles, Cal.
San Francisco: A. H. Coates Company, 1142 Howard St., San Francisco, Cal.

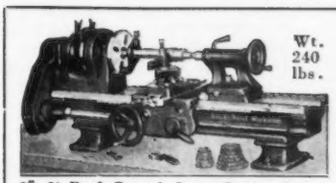
Die Heads

LELAND-GIFFORD COMPANY

Worcester, Mass.
Drilling Machinery
Belt and Motor Spindle
One to Six Spindles
Tapping Attachments and Multiple Heads

THE CLEVELAND STEEL TOOL CO.

Punches. Dies. Chisels. Rivet Sets
660 E. 82ª St. Cleveland, O.
If it's RIVETED you KNOW it's safe



Wt. 240 lbs.

9″x3′ Back-Geared, Screw Cutting "Workshop" Bench Lathe..... $75

SOUTH BEND LATHES

96 other sizes and types of Back-Geared, Screw Cutting Lathes from 9″ to 18″ swing, $75 to $1500, on terms if desired, shown in new General Catalog No. 94. Write for copy.

South Bend Lathe Works
591 E. Madison St.,
South Bend, Indiana, U. S. A.

V&O POWER PRESSES

AUTOMATIC FEEDS
AUTOMATIC THREADING MACHINES
THE V & O PRESS CO., HUDSON, N. Y.

ABRASIVE SURFACE GRINDER

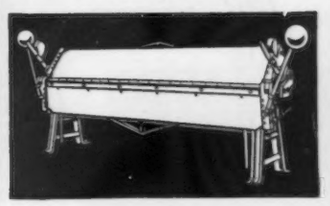
Either Horizontal or Vertical Spindle Type Countershaft or Motor Drive

Get our bulletin for particulars

ABRASIVE MACHINE TOOL CO., East Providence, R. I.

CHICAGO

BUILT OF STEEL



BRAKES, PRESSES AND SHEARS

DREIS & KRUMP MFG. CO.
7430 LOOMIS BLVD. CHICAGO, ILL.

Landis makes a complete line of threading equipment. Depend upon it, if you have a threading operation, Landis has a machine, die head or tap that will handle the job to better advantage.

Write today for literature.

LANDIS MACHINE CO., Inc.
Waynesboro, Penna., U. S. A.

MARVEL Tapping Machines

7 Models (sizes) 7 Capacity Ratings. 7 Spindle Speeds.

A Complete Line of horizontal, friction type, motor driven Tapping Machines that do the work of much more expensive and complicated machines. Fine Thread 0 to ½″ U.S.S. Taps in Steel. Complete accessories for all models.

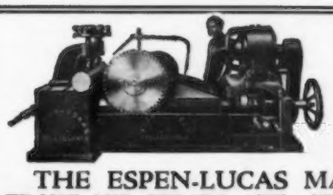
Armstrong-Blum Mfg. Co. *"The Hack Saw People"*
349 N. Francisco Ave., Chicago, U.S.A.

Write for Bulletin No. 500

MANGANO NON SHRINKABLE DIE STEEL

ALSO HIGH SPEED STAINLESS & CARBON TOOL STEELS

LATROBE ELECTRIC STEEL CO.
LATROBE PA.

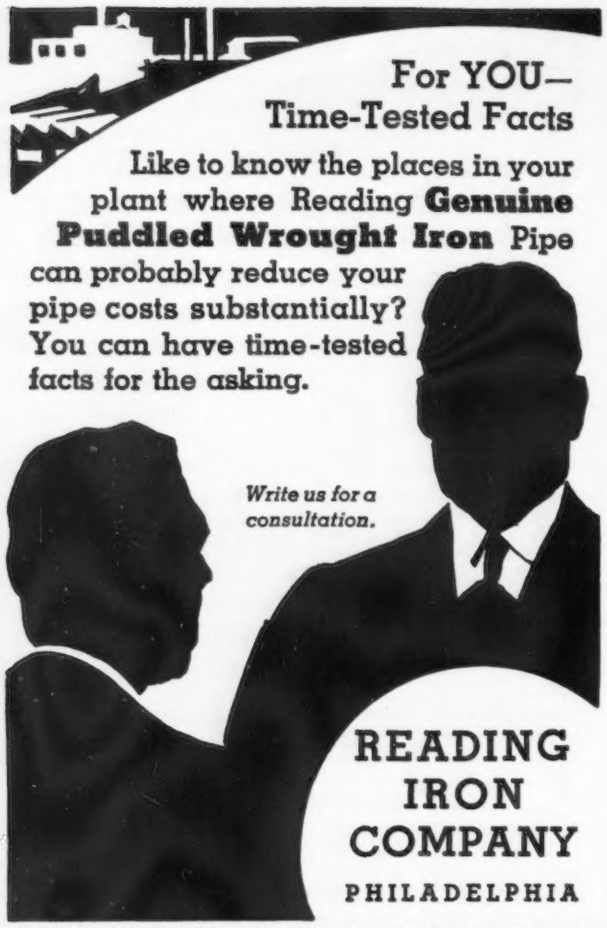


Cutting Off Machines for Sawing All Kinds of Metals

THE ESPEN-LUCAS MACHINE WORKS
FRONT AND GIRARD AVE. PHILADELPHIA, PENNA.

IF A COMPANY IN YOUR LINE

has found a better way of doing a thing, the probabilities are that your business paper tells about it.


For YOU—
Time-Tested Facts
Like to know the places in your plant where Reading Genuine Puddled Wrought Iron Pipe can probably reduce your pipe costs substantially? You can have time-tested facts for the asking.
Write us for a consultation.
READING IRON COMPANY
PHILADELPHIA

SCIENCE AND INVENTION HAVE NEVER FOUND A SATISFACTORY SUBSTITUTE FOR GENUINE PUDDLED WROUGHT IRON

SAVE WITH STEEL

WEIRTON

WEIRTON PRODUCTS

Pig Iron — Open Hearth Steel — Billets — Slabs—Sheet Bars—Skelp—Angles, Beams and Channels — Round, Square and Flat Bars — Rails — Steel Plates — Tie Plates—Track Spikes — Splice Bars — Reinforcing Bars — Coke Tin Plate — Kanners Special Cokes — Best Cokes — Charcoals — Lacquered Tin Plate—Tin Mill Black Plate (All Finishes)—Lacquered Black Plate—Copper Bearing Terne Plate—Hot and Cold Rolled Strip Steel and Strip Steel Sheets—High Finish Sheets—Long Terne Sheets (Common and Special Finishes) — Galvanized Black and Blue Annealed Sheets—Corrugated Sheets, V Crimp Sheets, Roll Roofing — Single Pickled, Full Finished and Auto Body Sheets —Coke—Tar—Benzol—Toluol — Ammonium Sulphate

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WEIRTON W. VA.
Division of National Steel Corporation
Sales Offices in All Principal Cities

BURDEN IRON

Manufacturers of Genuine Wrought Iron Products
Staybolt Iron—solid and hollow rolled.
Hollow Rolled Staybolts. Engine Bolt and Chain Iron.
Iron Rivets and Rivet Iron. "BURDEN BEST" Wrought Iron.

COMPANY TROY NEW YORK

METALINE
(REGISTERED TRADE MARK)
OILLESS BEARINGS THAT REQUIRE NO ATTENTION
R. W. RHOADES METALINE CO., INC.
43—3rd St., Long Island City, N. Y.

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ABRASIVE WHEELS — See Grinding Wheels

ABRASIVE CLOTH & PAPER
Norton Co., Worcester, Mass.

ABRASIVES—Steel Shot and Grit
American Foundry Equipment Co., Mishawaka, Ind.
Pangborn Corporation, Hagerstown, Md.

ACCUMULATORS—Hydraulic
Baldwin-Southwark Corp., Southwark Div., Philadelphia.
Wood, R. D., & Co., Philadelphia.

ACETYLENE—Dissolved in Cylinders
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

ACID RECOVERY EQUIPMENT
Chemical Construction Corp., 30 Rockefeller Plaza, New York City.

ACIDS—Pickling
American Chemical Paint Co., Ambler, Pa.

AIR TANKS AND CYLINDERS
Scaife, William B., & Sons Co., Ptgh.

ALLOYS—Calcium-Silicon
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.

ALLOYS—Magnesium
Dow Chemical Co., 921 Jefferson Ave., Midland, Mich.

ALLOYS—Phosphor Bronze
Phosphor Bronze Smelting Co., Phila.
Riverside (N. J.) Metal Co.
Ryerson, Jos. T., & Son, Inc., Chicago.

ALLOYS—Silico-Manganese
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.

ALLOYS—Titanium
Metal & Thermit Corp., 120 B'way, N. Y. C.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

ALLOYS—Tungsten
Vanadium Corp. of America, 120 Broadway, N. Y. C.

ALLOYS—Vanadium
Vanadium Corp. of America, 120 Broadway, N. Y. C.

ALLOYS—Zinc Base Die Casting
New Jersey Zinc Co., The, 160 Front St., N. Y. C.

ALUMINUM
Aluminum Co. of America, Pittsburgh.
Seligman, Arthur, & Co., Inc., 30 Rockefeller Plaza, R. C. A. Bldg., N. Y. C.

AMMETERS AND VOLTMETERS—Recording
Bristol Co., The, Waterbury, Conn.

AMMONIA RECOVERY PLANTS
Koppers Construction Co., The, Pittsburgh.

ANGLES, BEAMS, CHANNELS AND TEES
Carnegie Steel Co., Pittsburgh.
Illinois Steel Co., Chicago.
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.
Pacific Coast Steel Corp., San Francisco, Calif.
Ryerson, Jos. T., & Son, Inc., Chicago.
Steel & Tubes, Inc., Cleveland.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Weirton (W. Va.) Steel Co.

ANGLES, BEAMS, CHANNELS & TEES —Magnesium Alloys
Dow Chemical Co., 921 Jefferson Ave., Midland, Mich.

ANNEALING—See Heat Treating

ANNEALING BOXES
United Engineering & Fdry. Co., Ptgh.
Wilson, Lee Engineering Co., Cleveland.

ANODES—All Types
Seymour (Conn.) Mfg. Co.
Udylite Co., The, Detroit.

ANODES—Cadmium
Udylite Co., The, Detroit.

ARBORS
Morse Twist Drill & Mch. Co., New Bedford, Mass.

ARMORING MACHINERY—Cable, Wire, Hose
Sleeper & Hartley, Inc., Worcester, Mass.

ARRESTERS—Spark
Harrington & King Perforating Co., Chi.

AXLES—Car or Locomotive
Carnegie Steel Co., Pittsburgh.
Illinois Steel Co., Chicago.

BALING PRESSES—Scrap—See Presses —Baling

BALLS—Burnishing
Abbott Ball Co., The, 1047 New Britain Ave., Hartford, Conn.
Hartford (Conn.) Steel Ball Co.

BALLS—Steel, Brass or Bronze
Abbott Ball Co., The, 1047 New Britain Ave., Hartford, Conn.
Fafnir Bearing Co., New Britain, Conn.
Hartford (Conn.) Steel Ball Co.
New Departure Mfg. Co., Bristol, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.

BANDS—Steel
Acme Steel Co., Chicago.
Bethlehem (Pa.) Steel Company.
Inland Steel Co., Chicago.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

BANDS—Welded
Amer. Welding & Mfg. Co., Warren, O.

BARREL COATING & RENOVATING MACHINES
Harnischfeger Corp., 4401 W. National Ave., Milwaukee.

BARRELS—Burnishing
Abbott Ball Co., The, 1047 New Britain Ave., Hartford, Conn.

BARRELS—Tumbling
Abbott Ball Co., The, 1047 New Britain Ave., Hartford, Conn.
Baird Mch. Co., The, Bridgeport, Conn.
Hartford (Conn.) Steel Ball Co.

BARS—Alloy
Republic Steel Corp., Youngstown, Ohio.

BARS—Aluminum.
Aluminum Co. of America, Pittsburgh.

BARS—Brass, Bronze or Copper
Bunting Brass & Bronze Co., Toledo, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.

BARS—Cold Drawn
Union Drawn Steel Co., Massillon, Ohio.

BARS—Concrete, Reinforcing
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.
Laclede Steel Co., St. Louis, Mo.
Pacific Coast Steel Corp., San Francisco, Calif.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

BARS—Magnesium Alloys
Dow Chemical Co., 921 Jefferson Ave., Midland, Mich.

BARS—Steel
Ames, W., & Co., Jersey City, N. J.
Andrews Steel Co., The, Newport, Ky.
Bethlehem (Pa.) Steel Company.
Carnegie Steel Co., Pittsburgh.
Illinois Steel Co., Chicago.
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Joseph T., & Son, Inc., Chicago.
Steel & Tubes, Inc., Cleveland.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Timken Roller Bearing Co., Canton, Ohio.
Timken Steel & Tube Co., The, Canton, O.
Weirton (W. Va.) Steel Co.
Youngstown (Ohio) Sheet & Tube Co.

BASES—Column, Machinery
Lukens Steel Co., Coatesville, Pa.

BATTERIES—Storage
Electric Storage Battery Co., Phila.
Gould Storage Battery Corp., Depew, N. Y.

BATTERY CHARGERS
Cutler-Hammer, Inc., Milwaukee.

BEAMS—See Angles, Beams, Channels and Tees

BEARINGS—Ball
Bantam Ball Bearing Co., The, South Bend, Indiana.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., Poughkeepsie, N. Y.
New Departure Mfg. Co., Bristol, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

BEARINGS—Brass and Bronze
Bunting Brass & Bronze Co., Toledo, O.
Ryerson, Jos. T., & Son, Inc., Chicago.

BEARINGS—Oilless
Bunting Brass & Bronze Co., Toledo, Ohio.
Rhoades, R. W. Metaline Co., Inc., Long Island City, N. Y.

BEARINGS—Quill
Bantam Ball Bearing Co., The, South Bend, Indiana.

BEARINGS—Radial
Bantam Ball Bearing Co., The, South Bend, Indiana.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., Poughkeepsie, N. Y.
Hyatt Roller Bearing Co., Newark, N. J.
New Departure Mfg. Co., Bristol, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

BEARINGS—Roll Neck
Bantam Ball Bearing Co., The, South Bend, Indiana.
S K F Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS—Roller
Bantam Ball Bearing Co., The, South Bend, Indiana.
Hyatt Roller Bearing Co., Newark, N. J.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Timken Roller Bearing Co., Canton, O.

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BEARINGS—Roller Tapered
Bantam Ball Bearing Co., The, South Bend, Indiana.
Timken Roller Bearing Co., Canton, O.

BEARINGS—Rolling Mill Equipment
Bantam Ball Bearing Co., The, South Bend, Indiana.
S K F Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS—Shaft Hanger
Fafnir Bearing Co., New Britain, Conn.
Hyatt Roller Bearing Co., Newark, N. J.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.

BEARINGS—Thrust
Bantam Ball Bearing Co., The, South Bend, Indiana.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., Poughkeepsie, N. Y.
Hyatt Roller Bearing Co., Newark, N. J.
New Departure Mfg. Co., Bristol, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.
Timken Roller Bearing Co., Canton, O.

BELT DRESSING
Graton & Knight Co., Worcester, Mass.

BELT FASTENERS
Bristol Co., The, Waterbury, Conn.
Clipper Belt Lacer Co., Grand Rapids, Mich.
Graton & Knight Co., Worcester, Mass.

BELT LACER
Bristol Co., The, Waterbury, Conn.
Clipper Belt Lacer Co., Grand Rapids, Mich.

BELT LACING
Graton & Knight Co., Worcester, Mass.

BELTING CEMENT
Graton & Knight Co., Worcester, Mass.

BELTING—Leather
Chicago (Ill.) Rawhide Mfg. Co., 1306 Elston Ave.
Graton & Knight Co., Worcester, Mass.
Schieren, Chas. A., Co., 30 Ferry St., N. Y. C.

BELTING—Metal, Conveyer, High and Low Temperature
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.

BELTING—Rubber
Goodrich, B. F., Co., Akron, Ohio.
Graton & Knight Co., Worcester, Mass.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., The, 2 Townsend St., Passaic, N. J.
Robins Conveying Belt Co., 15 Park Row, N. Y. C.

BELTS—V-Type
Graton & Knight Co., Worcester, Mass.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., The, 2 Townsend St., Passaic, N. J.

BENDING MACHINES—Hand, Band and Angle
Excelsior Tool & Mch. Co., E. St. Louis, Ill.
Wallace Supplies Mfg. Co., Chicago.

BENDING MACHINES—Hand and Power
Buffalo (N. Y.) Forge Co., 492 B'way
Cincinnati (Ohio) Shaper Co.
Dreis & Krump Mfg. Co., Chicago.
Wallace Supplies Mfg. Co., Chicago.

BENZOL RECOVERY PLANTS
Koppers Construction Co., The, Pittsburgh.

BERYLLIUM COPPER
Riverside (N. J.) Metal Co.

BILLETS—Alloy Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Carbon Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Carbon Vanadium Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Chrome Nickel Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Chrome Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Die Block Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Forging
Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Central Iron & Steel Co., Harrisburg, Pa.
Harrisburg (Pa.) Steel Corp.
Lukens Steel Co., Coatesville, Pa.
Midvale Co., The, Nicetown, Phila., Pa.
Republic Steel Corp., Youngstown, Ohio.

BILLETS—Nickel Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Re-rolling
Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.

BILLETS—Steel
Bethlehem (Pa.) Steel Company.
Central Iron & Steel Co., Harrisburg, Pa.
Continental Steel Corp., Kokomo, Ind.
Inland Steel Co., Chicago.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

BLANKS—Chisel
Cleveland Steel Tool Co., The, 660 E. 82nd St., Cleveland, Ohio.

BLANKS—Gear and Pinion
Chicago (Ill.) Rawhide Mfg. Co., 1306 Elston Ave.

BLANKS, STEEL—Gear, Flywheel
Lukens Steel Co., Coatesville, Pa.

BLOCKS—Chain
Yale & Towne Mfg. Co., Stamford, Conn.

BLOWERS
American Gas Furnace Co., Elizabeth, N.J.
Buffalo (N. Y.) Forge Co., 492 Broadway.
Spencer Turbine Co., Hartford, Conn.

BLOWERS—Centrifugal
General Electric Co., Schenectady, N. Y.

BLOWPIPES — Soldering, Heating, Annealing
Weldit Acetylene Co., Detroit.

BOARDS—Hammer
Irwin, H. G., Lumber Co., 1129 State St., Erie, Pa.

BOILERS—Waste Heat
Babcock & Wilcox Co., The, 85 Liberty St., N. Y. C.

BOILERS—Water Tube
Babcock & Wilcox Co., The, 85 Liberty St., N. Y. C.

BOLT CUTTERS
Acme Mchry. Co., Cleveland, O.
Landis Mch. Co., Inc., Waynesboro, Pa.
National Mchry. Co., Tiffin, Ohio.

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland.
Landis Machine Co., Inc., Waynesboro, Pa.
National Mchry. Co., Tiffin, Ohio.
Waterbury (Ct.) Farrel Fdry. & Mch. Co.

BOLT & RIVET CLIPPERS
Helwig Mfg. Co., St. Paul, Minn.

BOLTS—Carriage and Machine
Republic Steel Corp., Upson Nut Div., Cleveland, O.

BOLTS—Special
Republic Steel Corp., Upson Nut Div., Cleveland, O.

BOLTS—Stove
Blake & Johnson Co., Waterville, Conn.

BOLTS—Track
Illinois Steel Co., Chicago.
Inland Steel Co., Chicago.
Republic Steel Corp., Upson Nut Div., Cleveland, O.

BOLTS AND NUTS
Ames, W., & Co., Jersey City, N. J.
Clark Bros. Bolt Co., Milldale, Conn.
Cleveland (Ohio) Cap Screw Co., The.
Oliver Iron & Steel Corp., Pittsburgh.
Pacific Coast Steel Corp., San Francisco, Calif.
Republic Steel Corp., Youngstown, O.
Ryerson, Jos. T., & Son, Inc., Chicago.

BOND—Grinding Wheel
Bakelite Corp., 247 Park Ave., N. Y. C.

BORING BARS
Bullard Co., The, Bridgeport.

BORING, DRILLING & MILLING MACHINES—Horizontal
Hill-Clarke Mchry. Co., 647 W. Washington Blvd., Chicago.

BORING & DRILLING MACHINES—Vertical
Bullard Co., The, Bridgeport.

BORING MACHINES—Diamond & Carbide Tools
Herld Mch. Co., Worcester, Mass.

BORING MACHINES—Jig
Pratt & Whitney Co., Hartford, Conn.

BORING & TURNING MILLS—Vertical
Bullard Co., The, Bridgeport.

BOXES—Steel
Berger Mfg. Co., The, Canton, Ohio.

BRAKES—Electric
Cutler-Hammer, Inc., Milwaukee.

BRAKES—Electric & Mechanical
Electric Controller & Mfg. Co., Cleveland.

BRAKES—Metal Forming
Cincinnati (Ohio) Shaper Co.
Dreis & Krump Mfg. Co., Chicago.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

BRICK—Fire Clay
Carborundum Co., The, Niagara Falls, N. Y.
Illinois Clay Products Co., Joliet, Ill.
Massillon (Ohio) Refractories Co.

BRICK—Insulating
Babcock & Wilcox Co., The, 85 Liberty St., N. Y. C.
Massillon (Ohio) Refractories Co.

BRIDGE BUILDERS
American Bridge Co., Pittsburgh.
Belmont Iron Works, Philadelphia.

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Revere Copper & Brass, Inc., 230 Park Ave., N. Y. C.
Riverside (N. J.) Metal Co.
Ryerson, Jos. T., & Son, Inc., Chicago.
Seymour (Conn.) Mfg. Co.

BUCKETS—Clamshell
Blaw-Knox Co., Pittsburgh.
Hayward Co., The, 50 Church St., N. Y. C.

BUCKETS—Electric Motor
Hayward Co., The, 50 Church St., N. Y. C.

BUCKETS—Elevator
Jeffrey Mfg. Co., The, Columbus, Ohio.

BUCKETS—Orange Peel
Hayward Co., The, 50 Church St., N. Y. C.

BUILDINGS—Steel
American Bridge Co., Pittsburgh.
Belmont Iron Works, Philadelphia.
Blaw-Knox Co., Pittsburgh.

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Beatty Mch. & Mfg. Co., 936—15th St., Hammond, Ind.

BULLDOZERS—Hydraulic
Elmes, Chas. F., Engng. Wks., Chicago.

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Phosphor Bronze Smelting Co., Phila.
Ryerson, Jos. T., & Son, Inc., Chicago.
Shenango-Penn Mold Co., Pittsburgh.

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BUSHINGS—Phosphor Bronze
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Phosphor Bronze Smelting Co., Phila.
Ryerson, Jos. T., & Son, Inc., Chicago.

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CADMIUM PLATING PROCESS
Udylite Co., The, Detroit.

CALCIUM CARBIDE
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

CARBIC
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

CARBIDE
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

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Norton Co., Worcester, Mass.

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Atlas Car & Mfg. Co., Cleveland.
Bartlett, C.O., & Snow Co.,The,Cleveland.

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Duriron Co., Inc., The, 438 N. Findlay St., Dayton, Ohio.
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Midvale Co., The, Nicetown, Phila., Pa.

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Aluminum Co. of America, Pittsburgh.
Aluminum Industries, Inc., Cincinnati.

CASTINGS—Brass, Bronze, Copper or Aluminum
Aluminum Industries, Inc., Cincinnati.
Cadman, A. W., Mfg. Co., Pittsburgh.
Phosphor Bronze Smelting Co., Phila.
Snyder, W. P., & Co., Pittsburgh.
Spencer's, I. S., Sons, Inc., Guilford, Ct.

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Aluminum Co. of America, Pittsburgh.
Aluminum Industries, Inc., Cincinnati.

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Dow Chemical Co., 921 Jefferson Ave., Midland, Mich.

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Crucible Steel Castings Co., Lansdowne,Pa.
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Malleable Iron Fittings Co., Branford, Ct.
Mesta Mch. Co., Pittsburgh.
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CEMENT—Quick Setting, Acid Proof and Insulator
Nukem Products Corp., 68 Niagara St., Buffalo.

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Massillon (Ohio) Refractories Co.

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Goodrich, B. F., Co., Akron, Ohio.

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Baldwin-Duckworth Chain Corp., Springfield, Mass.
Bartlett, C. O., & Snow Co.,The,Cleveland.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Link-Belt Co., Chicago.

CHAINS—Power Transmission
Baldwin-Duckworth Chain Corp., Springfield, Mass.
Boston Gear Works, Inc., North Quincy, Mass.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Link-Belt Co., Chicago.
Whitney Mfg. Co., Hartford, Conn.

CHAINS—Roller
Baldwin-Duckworth Chain Corp., Springfield, Mass.
Bartlett, C. O., & Snow Co.,The,Cleveland.
Whitney Mfg. Co., Hartford, Conn.

CHAINS—Silent
Link-Belt Co., Chicago.
Whitney Mfg. Co., Hartford, Conn.

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Noble & Westbrook Mfg. Co., East Hartford, Ct.

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Alrose Chemical Co., Providence, R. I.
Parker Rust-Proof Co., 2186 Milwaukee Ave., Detroit.
Udylite Co., The, Detroit.

CHROMIUM METAL
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.

CHUCKING MACHINES—Multiple Spindle
Baird Mch. Co., The, Bridgeport, Conn.

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Cleveland (Ohio) Twist Drill Co.
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Morse Twist Drill & Mach. Co., New Bedford, Mass.

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Cushman Chuck Co., Hartford, Conn.

CHUCKS—Lathe
Cushman Chuck Co., Hartford, Conn.

CHUCKS—Magnetic
Heald Mch. Co., Worcester, Mass.

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Revere Copper & Brass, Inc., 230 Park Ave., N. Y. C.
Riverside (N. J.) Metal Co.

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Danly Machine Specialties, Inc., Chicago.

CLEANERS—Metal
American Chemical Paint Co., Ambler, Pa.
Ford, J. B., Co., Wyandotte, Mich.
Nukem Products Corp., 68 Niagara St., Buffalo.

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Medart Co., The, St. Louis, Mo.

CLUTCHES—Magnetic
Cutler-Hammer, Inc., Milwaukee.
Dings Magnetic Separator Co., Milwaukee.
Magnetic Mfg. Co., 626 South 28th St., Milwaukee.

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Jeffrey Mfg. Co., The, Columbus, Ohio.
Robins Conveying Belt Co., 15 Park Row, N. Y. C.

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Pickands Mather & Co., Cleveland.

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Koppers Construction Co., The, Pittsburgh.

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Koppers Construction Co., The, Pittsburgh.

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Socony-Vacuum Oil Co., Inc., 26 Broadway, N. Y. C.
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American Steel & Wire Co., Chicago.

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Worthington Pump & Mchry. Corp., Harrison, New Jersey.

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Albert & Davidson Pipe Corp., 2nd Ave., 50-51st St., Bklyn, N. Y.
Albert Pipe Supply Co., Inc., Berry & N. 13th St., Bklyn, N. Y.

CONTROLLERS—Crane
Cutler-Hammer, Inc., Milwaukee.

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Electric Controller & Mfg. Co., Cleveland.
General Electric Co., Schenectady, N. Y.

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Cutler-Hammer, Inc., Milwaukee.
Vickers, Inc., 1420 Oakman Blvd., Detroit.

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Jeffrey Mfg. Co., The, Columbus, Ohio.
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Sun Oil Co., Philadelphia.
Tide Water Oil Co., 17 Battery Place, N. Y. C.

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Hubbard, M. D., Spg. Co., Pontiac, Mich.
Western Wire Prods. Co., St. Louis, Mo.

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Morse Twist Drill & Mch. Co., New Bedford, Mass.

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Industrial Brownhoist Corp., Bay City, Mich.
Link-Belt Co., Chicago.
Ohio Locomotive Crane Co., Bucyrus, Ohio.

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CRANES—Electric Traveling
Armel, James P., Pitgh.
Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Harnischfeger Corp., 4401 W. National Ave., Milwaukee, Wis.
Morgan Engineering Co., Alliance O.
Robbins & Myers, Inc., Springfield, Ohio.
Shaw-Box Crane & Hoist Co., Inc., 402 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.
Whiting Corp., Harvey, Ill.

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Morgan Engineering Co., Alliance, Ohio.
Whiting Corp., Harvey, Ill.

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Louden Mchry Co., Fairfield, Iowa.
Shaw-Box Crane & Hoist Co., Inc., 402 Broadway, Muskegon, Mich.

CRANES—Jib
Shaw-Box Crane & Hoist Co., Inc., 402 Broadway, Muskegon, Mich.

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Ohio Locomotive Crane Co., Bucyrus, Ohio.

CRANES—Monorail
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Cleveland Tramrail, Wickliffe, Ohio.
Louden Mchry. Co., Fairfield, Iowa.
Shaw-Box Crane & Hoist Co., Inc., 402 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

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Morse Twist Drill & Mch. Co., New Bedford, Mass.
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CUTTING-OFF MACHINES—Cold Saw
Espen-Lucas Mch. Wks., Philadelphia.

CUTTING-OFF MACHINES — Pipe or Tubing
Bardons & Oliver, Cleveland.
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CYLINDERS — Compressed Air & Hydraulic
Tomkins-Johnson Co., Jackson, Mich.

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Harrisburg (Pa.) Steel Corp.
National Tube Co., Pittsburgh.

DEOXIDIZERS
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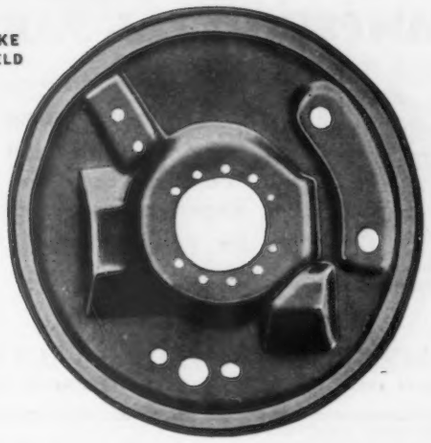

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Buffalo (N. Y.) Forge Co., 492 Broadway.
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DUST COLLECTORS
American Blower Corp., 6000 Russell St., Detroit.
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ECONOMIZERS
Babcock & Wilcox Co., The, 85 Liberty St., N. Y. C.

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ELECTRIC LIGHT PLANTS
Harnischfeger Corp., 4401 W. National Ave., Milwaukee.

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ENAMELING
Geuder, Paeschke & Frey Co., Milwaukee.

ENGINEERS—Consulting and Industrial
Eisler Engineering Co., Inc., 754 S. 13th St., Newark, N. J.
Hobbs, Harold G., P. O. Box 5973, Cleveland.
Koppers Construction Co., The, Pittsburgh.
Perin Engineering Co., Inc., 535 Fifth Ave., N. Y. C.

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American Blower Corp., 6000 Russell St., Detroit.

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Harrisburg (Pa.) Steel Corp.

FEEDS—Hydraulic, for Machines
Oilgear Co., The, 1311 W. Bruce St., Milwaukee.

FELT—Wool Mechanical
Booth Felt Co., Inc., 435—18th St., Brooklyn, N. Y.

FENCING—Wire
Continental Steel Corp., Kokomo, Ind.
Pittsburgh (Pa.) Steel Co.

FERRO ALLOYS—Chromium
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.
Metal & Thermit Corp., 120 Broadway, N. Y. C.
Ohio Ferro-Alloys Co., Canton, Ohio.
Pittsburgh Metallurgical Co., Inc., Niagara Falls, N. Y.
Samuel, Frank, & Co., Philadelphia.
Vanadium Corp. of America, 120 B'way, N. Y. C.

FERRO ALLOYS—Columbium
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.

FERRO ALLOYS—Manganese
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.
Ohio Ferro-Alloys Co., Canton, Ohio.
Pittsburgh Metallurgical Co., Inc., Niagara Falls, N. Y.
Samuel, Frank, & Co., Phila.

FERRO ALLOYS—Molybdenum
Climax Molybdenum Co., 500 Fifth Ave., N. Y. C.
Vanadium Corp. of America, 120 Broadway, N. Y. C.

FERRO ALLOYS—Silico Manganese
Electro Metallurgical Sales Corp., 30 E. 42nd St., N. Y. C.
Ohio Ferro-Alloys Co., Canton, Ohio.
Vanadium Corp. of America, 120 Broadway, N. Y. C.

FERRO ALLOYS—Silicon
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.
Ohio Ferro-Alloys Co., Canton, Ohio.
Pittsburgh Metallurgical Co., Inc., Niagara Falls, N. Y.
Samuel, Frank, & Co., Phila.
Vanadium Corp. of America, 120 Broadway, N. Y. C.

FERRO ALLOYS—Silicon-Aluminum
Vanadium Corp. of America, 120 Broadway, N. Y. C.

FERRO ALLOYS—Spiegeleisen
Electro Metallurgical Sales Corp., 30 E. 42nd St., N. Y. C.
New Jersey Zinc Co., The, 160 Front St., N. Y. C.

FERRO ALLOYS—Titanium
Metal & Thermit Corp., 120 Broadway, N. Y. C.
Titanium Alloys Mfg. Co., Niagara Falls, N. Y.
Vanadium Corp. of America, 120 Broadway, N. Y. C.

FERRO ALLOYS—Tungsten
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.
Metal & Thermit Corp., 120 B'way, N. Y. C.

FERRO ALLOYS—Vanadium
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.
Metal & Thermit Corp., 120 B'way, N. Y. C.
Vanadium Corp. of America, 120 Broadway, N. Y. C.

FERRO ALLOYS—Zirconium
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.

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Nicholson File Co., Providence, R. I.

FILTERS—Pressure or Gravity
Scaife, Wm. B., & Sons Co., Pittsburgh.

FIRE BRICK—Insulating
Babcock & Wilcox Co., The, 85 Liberty St., N. Y. C.
Massillon (Ohio) Refractories Co.

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FIRE CLAY
Carborundum Co., The, Perth Amboy, N. J.
Illinois Clay Products Co., Joliet, Ill.
Massillon (Ohio) Refractories Co.

FITTINGS—Brass, Pipe and Tube
Commonwealth Brass Corp., Detroit.
Weatherhead Co., The, Cleveland.

FITTINGS, CAST IRON—Rubber Lined
American Hard Rubber Co., 11 Mercer St., N. Y. C.

FLANGES—Forged Steel
Harrisburg (Pa.) Steel Corp.
Taylor Forge & Pipe Works, Chicago.

FLANGING WORK—Carbon and Alloy
Lukens Steel Co., Coatesville, Pa.
Worth Steel Co., Claymont, Del.

FLOODLIGHTS—Acetylene
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

FLOOR PLATES—See Plates—Floor or Cellar Door

FLOORING—Acid Proof
Nukem Products Corp., 68 Niagara St., Buffalo.

FLOORING—Open Steel
Blaw-Knox Co., Pittsburgh.
Hendrick Mfg. Co., Carbondale, Pa.

FLOORING—Steel
Central Iron & Steel Co., Harrisburg, Pa.

FLUX—Welding
Linde Air Prods. Co., The, 30 E. 42nd St., N. Y. C.

FORGING MACHINES—Upset
Acme Machinery Co., Cleveland.
National Mchry. Co., Tiffin, Ohio.

FORGINGS—Alloy Steel
National Forge & Ordnance Co., Irvine, Pa.

FORGINGS—Aluminum
Aluminum Co. of America, Pittsburgh.

FORGINGS—Brass, Bronze or Copper
Commonwealth Brass Corp., Detroit.
Revere Copper & Brass, Inc., 230 Park Ave., N. Y. C.

FORGINGS—Coin Pressed
Rockford (Ill.) Drop Forge Co.

FORGINGS—Drop, Iron or Steel
Atlas Drop Forge Co., Lansing, Mich.
Canton (Ohio) Drop Forging & Mfg. Co.
Canton (Ohio) Forge & Axle Co.
Forging & Casting Corp., The, Ferndale, Mich.
Oliver Iron & Steel Corp., Pittsburgh.
Rockford (Ill.) Drop Forge Co.

FORGINGS—Hollow
Harrisburg (Pa.) Steel Corp.
National Forge & Ordnance Co., Irvine, Pa.

FORGINGS—Hydraulic Press, Iron or Steel
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Bethlehem (Pa.) Steel Company.
Mesta Mch. Co., Pittsburgh.
Midvale Co., The, Nicetown, Phila., Pa.
National Forge & Ordnance Co., Irvine, Pa.

FORGINGS—Magnesium Alloys
Dow Chemical Co., 921 Jefferson Ave., Midland, Mich.

FORGINGS—Upset
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Jeffrey Mfg. Co., The, Columbus, Ohio.

FUME DUCTS—Rubber Lined
American Hard Rubber Co., 11 Mercer St., N. Y. C.

FURNACE ENGINEERS
Electric Furnace Co., The, Salem, Ohio.
Flinn & Dreffein Co., Chicago.
Wilson, Lee Engineering Co., The, Cleveland.

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Electric Furnace Co., The, Salem, Ohio.
Wilson, Lee Engineering Co., Cleveland.

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General Electric Co., Schenectady, N. Y.
Pittsburgh (Pa.) Lectromelt Furnace Corp.

FURNACES—Enameling
Carborundum Co., The, Perth Amboy, N. J.
Electric Furnace Co., The, Salem, Ohio.
Mahr Mfg. Co., Minneapolis, Minn.

FURNACES—Forging
Electric Furnace Co., The, Salem, Ohio.
Holcroft & Co., Detroit.
Mahr Mfg. Co., Minneapolis, Minn.
Wilson, Lee Engineering Co., The, Cleveland.

FURNACES—Heat Treating, Automatic
Electric Furnace Co., The, Salem, Ohio.
Holcroft & Co., Detroit.
Rockwell, W. S., Co., 50 Church St., N. Y. C.

FURNACES—Heat Treating, Cyanide or Lead
Amer. Gas Furnace Co., Elizabeth, N. J.
Chicago (Ill.) Flexible Shaft Co.
Electric Furnace Co., The, Salem, Ohio.
Mahr Mfg. Co., Minneapolis, Minn.

FURNACES—Heat Treating, Electric
Electric Furnace Co., The, Salem, Ohio.
General Electric Co., Schenectady, N. Y.
Holcroft & Co., Detroit.
Hoskins Mfg. Co., Detroit, Mich.
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Rockwell, W. S., Co., 50 Church St., N. Y. C.

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Rockwell, W. S., Co., 50 Church St., N. Y. C.
Wilson, Lee Engineering Co., The, Cleveland.

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Wean Engineering Co., Inc., The, Warren, Ohio.

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General Electric Co., Schenectady, N. Y.

FURNACES—Wire, Annealing and Galvanizing
General Electric Co., Schenectady, N. Y.

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Pratt & Whitney Co., Hartford, Conn.

GAGES—Pressure and Vacuum, Recording
Bristol Co., The, Waterbury, Conn.

GAGES—Thickness, for Rolling Mills
Haines Gauge Co., The, Phila., Pa.

GAGES—Thread Lead
Jones & Lamson Mch. Co., Springfield, Vt.

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Wood, R. D., & Co., Philadelphia.

GAS RECOVERY COKE OVENS
Koppers Construction Co., The, Pittsburgh.

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Garlock Packing Co., The, Palmyra, N. Y.

GASKETS—Leather
Graton & Knight Co., Worcester, Mass.

GASKETS—Rubber
American Hard Rubber Co., 11 Mercer St., N. Y. C.
Goodrich, B. F., Co., Akron, Ohio.

GATES—Blast
Rockwell, W. S., Co., 50 Church St., N. Y. C

GEAR CUTTING
Currie, J. B., & Son, 70-72 Adams St., Brooklyn, N. Y.
Earle Gear & Machine Co., Phila.
Farrel-Birmingham Co., Inc., Buffalo, N. Y.
Gleason Works, Rochester, N. Y.
Philadelphia (Pa.) Gear Works.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.

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Gleason Works, Rochester, N. Y.

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Lewis Foundry & Mch. Co., Pittsburgh.
Link-Belt Co., Chicago.
United Engineering & Fdry. Co., Ptgh.

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GEARMOTORS
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Westinghouse Elec. & Mfg. Co., East Ptgh.

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GEAR TESTING MACHINES
Lees-Bradner Co., Cleveland.

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Gleason Works, Rochester, N. Y.

GEARS—Heat Treated
Gleason Works, Rochester, N. Y.
Simonds Mfg. Co., Pittsburgh.

GEARS—Herringbone
Farrel-Birmingham Co., Inc., Buffalo, N. Y.
Mesta Mch. Co., Pittsburgh.
Philadelphia (Pa.) Gear Works.

GEARS—Machine Cut
Boston Gear Wks., Inc., North Quincy, Mass.
Gleason Works, Rochester, N. Y.
Simonds Mfg. Co., Pittsburgh.

GEARS—Non-Metallic
Boston Gear Wks., Inc., North Quincy, Mass.
Chicago (Ill.) Rawhide Mfg. Co., 1306 Elston Ave.
General Electric Co., Schenectady, N. Y.

GEARS—Rawhide
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Michigan Tool Co., Detroit.
Philadelphia (Pa.) Gear Works.

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Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

GENERATORS—Electric
Fairbanks, Morse & Co., Chicago.
Lincoln Electric Co., Cleveland.
Reliance Electric & Engineering Co., Cleveland.
Westinghouse Elec. & Mfg. Co., East Ptgh.

GENERATORS—Electric, Second Hand
Belyea Co., Inc., 147 W. 18th St., N. Y. C.

GLUE HEATERS
Dart, E. M., Mfg. Co., Prov., R. I.

GOGGLES—Safety
American Optical Co., Southbridge, Mass.

GOVERNORS—Air Compressor
Westinghouse Air Brake Co., Industrial Div., Pittsburgh.

GRATING—Flooring, Sidewalk, etc.—See Flooring—Open Steel

GREASE—Lubricating
Gulf Refining Co., Pittsburgh.
Socony-Vacuum Oil Co., Inc., 26 Broadway, N. Y. C.
Sun Oil Co., Philadelphia.
Tide Water Oil Co., 17 Battery Place, N. Y. C.

GRILLES—Perforated Metal
Erdle Perforating Co., Rochester, N. Y.
Harrington & King Perforated Co., Chicago.

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Excelsior Tool & Mch. Co., E.St.Louis, Ill.
Norton Co., Worcester, Mass.

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Cincinnati (Ohio) Grinders, Inc.

GRINDING MACHINES — Cutter & Reamer
Cincinnati (Ohio) Grinders, Inc.
Landis Tool Co., Waynesboro, Pa.

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Cincinnati (Ohio) Grinders, Inc.
Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

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GRINDING MACHINES—Gear & Worm
Lees-Bradner Co., Cleveland.
Pratt & Whitney Co., Hartford, Conn.

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Heald Mch. Co., Worcester, Mass.

GRINDING MACHINES—Internal Centerless
Heald Mch. Co., Worcester, Mass.

GRINDING MACHINES—Internal Multiple Spindle
Baird Mch. Co., The, Bridgeport, Conn.

GRINDING MACHINES—Portable Pneumatic
Buckeye Portable Tool Co., The, Dayton, Ohio.

GRINDING MACHINES—Roll
Cincinnati (Ohio) Grinders, Inc.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES—Surface
Abrasive Machine Tool Co., E. Prov., R. I.
Heald Mch. Co., Worcester, Mass.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.

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Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDING MACHINES—Universal
Cincinnati (Ohio) Grinders, Inc.
Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDING MACHINES—Valve
Landis Tool Co., Waynesboro, Pa.

GRINDING WHEEL DRESSERS AND CUTTERS
Calder, Geo. H., Co., Lancaster, Pa.

GRINDING WHEELS
Bakelite Corp., 247 Park Ave., N. Y. C.
Carborundum Co., The, Niagara Falls, N. Y.
Macklin Co., Jackson, Mich.
Norton Co., Worcester, Mass.

GRIPS—Cable
Smith Devices, Philadelphia.

GRIPS—Plate
Smith Devices, Philadelphia.

GRIT—Steel
Pittsburgh (Pa.) Crushed Steel Co.

HACK SAW BLADES—See Saws—Hack Saw Blades

HACK SAW MACHINES
Armstrong-Blum Mfg. Co., Chicago.

HAMMERS—Air, Forging
Nazel Engng. & Mch. Wks., Philadelphia.

HAMMERS—Drop
Chambersburg (Pa.) Engineering Co.
Erie (Pa.) Foundry Co.
Morgan Engineering Co., Alliance, Ohio.

HAMMERS—Power
Chambersburg (Pa.) Engineering Co.

HAMMERS—Rawhide
Chicago (Ill.) Rawhide Mfg. Co., 1306 Elson Ave.

HAMMERS—Steam
Erie (Pa.) Foundry Co.
Morgan Engineering Co., Alliance, Ohio.

HANGERS—Ball Bearing
Fafnir Bearing Co., New Britain, Conn.
S K F Industries, Inc., Front St. & Erie Ave., Phila., Pa.

HANGERS—Roller Bearing
Hyatt Roller Bearing Co., Newark, N. J.

HARDNESS TESTING MACHINES
Shore Instrument & Mfg. Co., The, Jamaica, L. I., N. Y.

HEADING MACHINES
National Mchry. Co., Tiffin Ohio.

HEADING MACHINES—Automatic, Electric
National Mchry. Co., Tiffin, Ohio.

HEADS—Spun and Pressed
Lukens Steel Co., Coatesville, Pa.
Worth Steel Co., Claymont, Del.

HEAT RESISTING PRODUCTS—Electric
Globar Corp., Niagara Falls, N. Y.

HEAT TREATING
Barnes-Gibson-Raymond, Inc., Detroit.
Barnes, Wallace Co., The, Bristol, Conn.
General Machine Wks., York, Pa.
Gibson, Wm. D., Co., Chicago.
Parish Pressed Steel Co., Reading, Pa.

HEATERS—Unit
Buffalo (N. Y.) Forge Co., 492 B'way.
Nelson, Herman Corp., The, Moline, Ill.

HEATING RESISTANCE—Non-Metallic
Globar Corp., Niagara Falls, N. Y.

HEATING & VENTILATING APPARATUS
Nelson, Herman Corp., The, Moline, Ill.

HOBS
Michigan Tool Co., Detroit.

HOISTS—Air
Detroit (Mich.) Hoist & Mach. Co.
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HOISTS—Chain
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Goodrich, B. F., Co., Akron, Ohio.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., The, 2 Townsend St., Passaic, N. J.

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Shenango Furnace Co., Pittsburgh.
Shenango-Penn Mold Co., Pittsburgh.
Snyder, W. P., & Co., Pittsburgh.

INGOTS—Aluminum
Aluminum Co. of America, Pittsburgh.
Seligman, Arthur, & Co., Inc., 30 Rockefeller Plaza, R. C. A. Bldg., N. Y. C.

INGOTS—Phosphor Bronze
Phosphor Bronze Smelting Co., Phila.

INHIBITORS
American Chemical Paint Co., Ambler, Pa.

INSTRUMENTS—Recording
Bristol Co., The, Waterbury, Conn.

IRON WORKERS—Universal
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IRON—Genuine Open Hearth Iron
Newport (Ky.) Rolling Mill Co.

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Ekstrand & Tholand, Inc., 441 Lexington Ave., N. Y. C.

IRON—Rustless
Ludlum Steel Co., Watervliet, N. Y.

IRON—Stainless
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.

IRON—Staybolt
Burden Iron Co., The, Troy, N. Y.

IRON—Wrought
Reading Iron Co., Philadelphia.

KEYS—Riveted
Western Wire Prods. Co., St. Louis, Mo.

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Davis Keyseater Co., 400 Exchange St., Rochester, N. Y.

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Roxalin Flexible Lacquer Co., Inc., Elizabeth, New Jersey.
Sherwin-Williams Co., Cleveland.
Zapon Co., The, Stamford, Conn.

LAMPS—Filament
General Electric Co., Cleveland, Ohio.

LAMPS—Mercury Vapor
General Electric Vapor Lamp Co., Hoboken, N. J.

LATHES—Automatic
Baird Mch. Co., The, Bridgeport, Conn.
Bullard Co., The, Bridgeport.
Jones & Lamson Mch. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford, Conn.

LATHES—Automatic Vertical
Baird Mch. Co., The, Bridgeport, Conn.
Bullard Co., The, Bridgeport, Conn.

LATHES—Bench
Pratt & Whitney Co., Hartford, Conn.
South Bend (Ind.) Lathe Works, 325 E. Madison St.

LATHES—Chucking
Jones & Lamson Mch. Co., Springfield, Vt.

LATHES—Engine
Hill-Clarke Mchry. Co., 647 W. Washington Blvd., Chicago.
South Bend (Ind.) Lathe Works, 325 E. Madison St.

LATHES—Roll
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Mesta Mch. Co., Pittsburgh.
United Engineering & Fdry. Co., Ptgh.

LATHES—Second-Hand
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Hendry, R. L., 1506 Santa Fe Ave., Los Angeles, Calif.
Miles Mchry. Co., Saginaw, W. S., Mich.
Simmons Mch. Tool Corp., Albany, N. Y.

LATHES—Turret
Bardons & Oliver, Cleveland.
Bullard Co., The, Bridgeport.
Kennard-Rafkin Machinery Corp., 225 Culver Ave., Jersey City, N. J.
Jones & Lamson Mch. Co., Springfield, Vt.

LATHES—Turret, Vertical
Bullard Co., The, Bridgeport, Conn.

LEAD—In Oil
Sherwin-Williams Co., Cleveland.

LEATHER—Cup
Chicago (Ill.) Rawhide Mfg. Co., 1306 Elston Ave.

LEVELING MACHINES
Wean Engineering Co., Inc., The, Warren.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

LIQUIDATORS
RCA Mfg. Co., Inc., Camden, N. J.

LOCK WASHER MACHINERY
Sleeper & Hartley, Inc., Worcester, Mass.

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Atlas Car & Mfg. Co., Cleveland.
General Electric Co., Schenectady, N. Y.

LOCOMOTIVES—Gasoline
Plymouth (Ohio) Locomotive Works.

LOCOMOTIVES—Industrial
Jeffrey Mfg. Co., The, Columbus, Ohio.
Plymouth (Ohio) Locomotive Works.

LOCOMOTIVES—Storage Battery
Atlas Car & Mfg. Co., Cleveland.

LUBRICANTS—Crusher & Grinding
Gulf Refining Co., Pittsburgh.
Socony-Vacuum Oil Co., Inc., 26 Broadway, N. Y. C.
Sun Oil Co., Philadelphia.
Tide Water Oil Co., 17 Battery Place, N. Y. C.

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Tide Water Oil Co., 17 Battery Place, N. Y. C.

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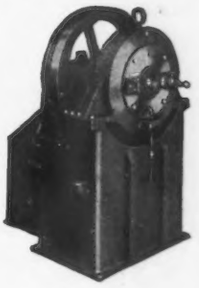
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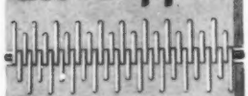

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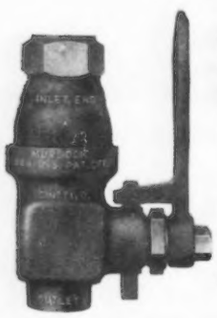

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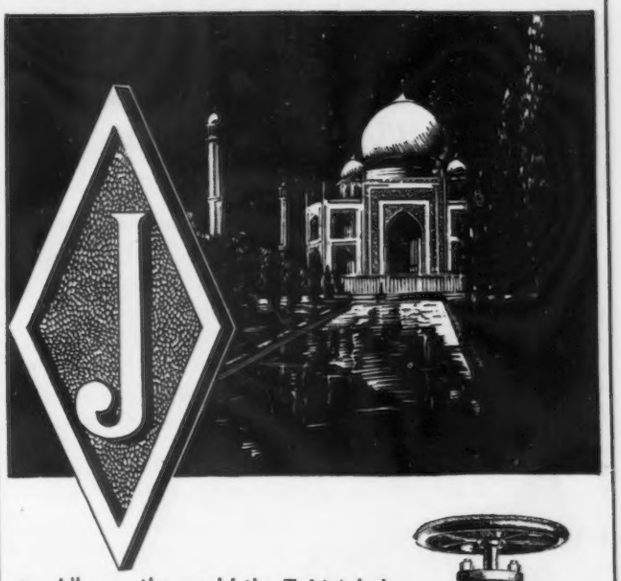

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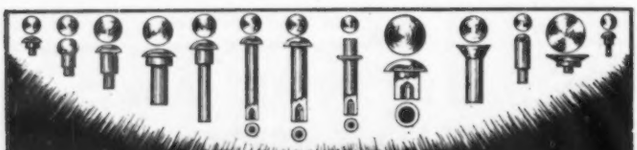
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Products Index

Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

REINFORCEMENT FABRIC—Concrete
Pittsburgh (Pa.) Steel Co.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.

RINGS—Iron or Steel
Midvale Co., The, Nicetown, Phila., Pa.

RINGS—Welded
American Welding & Mfg. Co., Warren, O.

RIVET MAKING MACHINERY
Acme Machinery Co., Cleveland.
National Mchry. Co., Tiffin, Ohio.

RIVET SETS
Cleveland Steel Tool Co., The, 660 E. 82d St., Cleveland, Ohio.

RIVETING MACHINES
Shuster, F. B., Co., New Haven, Conn.

RIVETS
Blake & Johnson Co., Waterville, Conn.
Champion Rivet Co., Cleveland, Ohio.
Clark Bros. Bolt Co., Milldale, Conn.
Hassall, John, Inc., Clay & Oakland Sts., Bklyn, N. Y.
Oliver Iron & Steel Corp., Pittsburgh.
Progressive Mfg. Co., Torrington, Conn.
Ryerson, Jos. T., & Son, Inc., Chicago.

RODS—Aluminum
Aluminum Co. of America, Pittsburgh.

RODS—Brass
American Brass Co., Waterbury, Conn.
Revere Copper & Brass, Inc., 230 Park Ave., N. Y. C.

RODS—Magnesium Alloys
Dow Chemical Co., 921 Jefferson Ave., Midland, Mich.

RODS—Nickel Silver
Riverside (N. J.) Metal Co.
Seymour (Conn.) Mfg. Co.

RODS—Phosphor Bronze
American Brass Co., Waterbury, Conn.
Phosphor Bronze Smelting Co., Phila.
Revere Copper & Brass, Inc., 230 Park Ave., N. Y. C.
Riverside (N. J.) Metal Co.
Ryerson, Jos. T., & Son, Inc., Chicago.
Seymour (Conn.) Mfg. Co.

RODS—Welding
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
American Brass Co., Waterbury, Conn.
American Steel & Wire Co., Chicago.
Champion Rivet Co., Cleveland.
Lincoln Electric Co., Cleveland.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.
Metal & Thermit Corp., 120 B'way, N. Y. C.
Pittsburgh (Pa.) Steel Co.
Revere Copper & Brass, Inc., 230 Park Ave., N. Y. C.

RODS—Wire
American Steel & Wire Co., Chicago.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh.
Pittsburgh (Pa.) Steel Co.
Wickwire Brothers, Cortland, N. Y.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.
Youngstown (Ohio) Sheet & Tube Co.

ROLLING MACHINERY—Cold Rolling
Lewis Foundry & Mch. Co., Pittsburgh.
United Engineering & Fdry. Co., Ptgh.

ROLLING MACHINERY—Sheet Metal
Lewis Foundry & Mch. Co., Pittsburgh.

ROLLING MILL MACHINERY
Cold Metal Process Co., The, Youngstown, Ohio.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hyde Park (Pa.) Fdry. & Mch. Co.
Lewis Foundry & Mch. Co., Pittsburgh.
Mesta Mch. Co., Pittsburgh.
Morgan Engineering Co., Alliance, O.
National Roll & Fdry. Co., Avonmore, Pa.
United Engineering & Fdry. Co., Ptgh.
Waterbury (Ct.) Farrel Fdry. & Mch. Co.

ROLLS—Alloy Steel
Pittsburgh (Pa.)) Rolls Corp.

ROLLS—Bending and Straightening
Baldwin-Southwark Corp., Southwark Div., Philadelphia.
Bertsch & Co., Cambridge City, Ind.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

ROLLS—Sand Chilled Iron and Steel
Hyde Park (Pa.) Fdry. & Mach. Co.
Lewis Foundry & Mch. Co., Pittsburgh.
Mesta Mch. Co., Pittsburgh.
National Roll & Fdry. Co., Avonmore, Pa.
Pittsburgh (Pa.) Rolls Corp.
United Engineering & Fdry. Co., Ptgh.

ROLLS—Special Hardened
Midvale Co., The Nicetown, Phila., Pa.

ROOFING—Special Copper Bearing Steel
Newport (Ky.) Rolling Mill Co.
Superior Sheet Steel Co., Canton, Ohio.

ROOFING AND SIDING—Corrugated and Plain
American Rolling Mill Co., Middletown, Ohio.
American Sheet & Tin Plate Co., Ptgh.
Newport (Ky.) Rolling Mill Co.
Weirton (W. Va.) Steel Co.
Youngstown (Ohio) Sheet & Tube Co.

ROOFING AND SIDING—Genuine Open Hearth Iron
Newport (Ky.) Rolling Mill Co.
Superior Sheet Steel Co., Canton, Ohio.

ROOFING AND SIDING—Iron and Steel
Newport (Ky.) Rolling Mill Co.

ROOFING AND SIDING—(Zinc) Corrugated and Plain
New Jersey Zinc Co., The, 160 Front St., N. Y. C.

RUBBER LININGS—Tank
American Hard Rubber Co., 11 Mercer St., N. Y. C.
Goodrich, B. F., Co., Akron, Ohio.

RUBBER MOLDED PARTS
American Hard Rubber Co., 11 Mercer St., N. Y. C.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., The, 2 Townsend St., Passaic, N. J.

RUST PREVENTIVES
American Chemical Paint Co., Ambler, Pa.
American Lanolin Corp., Lawrence, Mass.
Parker Rust-Proof Co., 2186 Milwaukee Ave., Detroit.

RUST PROOFING COMPOUNDS
Parker Rust-Proof Co., 2186 Milwaukee Ave., Detroit.

RUST PROOFING PROCESS
Parker Rust-Proof Co., 2186 Milwaukee Ave., Detroit.
Udylite Co., The, Detroit.

RUST REMOVING
American Chemical Paint Co., Ambler, Pa.
Nukem Products Corp., 68 Niagara St., Buffalo.

SAND BLAST EQUIPMENT AND MACHINES
American Foundry Equipment Co., Mishawaka, Ind.
Arcade Mfg. Co., Freeport, Ill.
Panghorn Corporation, Hagerstown, Md.

SAND BLAST STEEL SHOT
American Foundry Equipment Co., Mishawaka, Ind.
Pittsburgh (Pa.) Crushed Steel Co.

SAND HANDLING EQUIPMENT
Bartlett, C. O., & Snow Co., The, Cleveland.
Jeffrey Mfg. Co., The, Columbus, Ohio.

SAWING MACHINES—Metal
Espen-Lucas Mch. Works, Phila.

SAWS—Band and Hack for Metal
Armstrong-Blum Mfg. Co., Chicago.
Atkins, E. C., & Co., Indianapolis.
Disston, Henry, & Sons, Inc., Philadelphia.
Wells Mfg. Co., Three Rivers, Mich.

SAWS—Circular, Rip & Cutoff
Atkins, E. C., & Co., Indianapolis.

SAWS—Friction
Atkins, E. C., & Co., Indianapolis.
Disston, Henry, & Sons, Inc., Philadelphia.

SAWS—Hack Saw Blades
Atkins, E. C., & Co., Indianapolis.

SAWS—Hot Metal
Atkins, E. C., & Co., Indianapolis.
Disston, Henry, & Sons, Inc., Philadelphia.

SAWS—Inserted Tooth, Cold
Disston, Henry, & Sons, Inc., Philadelphia
Tabor Mfg. Co., Philadelphia.

SAWS—Milling
Atkins, E. C., & Co., Indianapolis.
Disston, Henry, & Sons, Inc., Philadelphia.

SCREENS—Perforated Metal
Erdle Perforating Co., Rochester, N. Y.
Harrington & King Perforating Co., Chi
Hendrick Mfg. Co., Carbondale, Pa.
Mundt, Chas., & Sons, 59 Fairmount Ave., Jersey City, N. J.

SCREENS—Woven Wire
Michigan Wire Cloth Co., 2117 Howard St., Detroit.
Wickwire Brothers, Cortland, N. Y.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.

SCREW MACHINE PRODUCTS
Barnes, Wallace, Co., The, Bristol, Conn.
Blake & Johnson Co., Waterville, Conn.
Cleveland (Ohio) Cap Screw Co., The.
Commonwealth Brass Corp., Detroit.
Eastern Mch. Screw Corp., New Haven, Conn.
Olson Mfg. Co., Worcester, Mass.
Ottemiller, Wm. H., Co., Inc., York, Pa.
Progressive Mfg. Co., Torrington, Conn.
Screw Mch. Products Corp., Prov., R. I.
Weatherhead Co. The, Cleveland

SCREW MACHINERY—Automatic
Cone Automatic Mach. Co., Inc., Windsor, Vt.

SCREW MACHINERY—Hand
Jones & Lamson Mch. Co., Springfield, Vt.

SCREW MACHINERY—Multiple Spindle
Cone Automatic Mach. Co., Inc., Windsor, Vt.

SCREW STOCKS
Union Drawn Steel Co., Massillon, Ohio.

SCREWS—Cap
Bristol Co., The, Waterbury, Conn.
Cleveland (Ohio) Cap Screw Co., The.
Ottemiller Wm. H., Co., Inc., York, Pa.

SCREWS—Cold Headed
Cleveland (Ohio) Cap Screw Co., The.

SCREWS—Machines
Blake & Johnson Co., Waterville, Conn.
Progressive Mfg. Co., The, Hartford, Conn.

SCREWS—Safety Set
Bristol Co., The, Waterbury, Conn.
Progressive Mfg. Co., The, Hartford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS—Set
Bristol Co., The, Waterbury, Conn.
Ottemiller, Wm. H., Co., Inc., York, Pa.

SCREWS, Socket, Head, Cap
Bristol Co., The, Waterbury, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS—Thumb
Parker-Kalon Corp., 196 Varick St., N. Y. C.

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SCYTHE STONES AND WHETSTONES
Carborundum Co., The, Niagara Falls, N. Y.

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American Air Compressor Corp., 562 Hamilton Ave., Brooklyn, N. Y.
Berndt, A. J., Co., Union City, N. J.
Botwinik Brothers, Inc., New Haven, Conn.
Cincinnati (Ohio) Mchry. & Supply Co.
Clarkson, D. R., Rochester, N. Y.
Clifton (N. J.) Paper Board Co., Inc.
Donahue Steel Prods. Co., 1609 W. 74th St., Chicago.
Eastern Machinery Co., 3263 Spring Grove Ave., Cincinnati, Ohio.
Essley E. L., Mchry. Co., Chicago.
Falk Mill Supply Co., Inc., Rochester.
Foster, Frank B., 829 Oliver Bldg., Pgh.
G-O Machinery & Liquidating Co., Buffalo.
Hendry, R. L., 1506 Santa Fe Ave., Los Angeles, Calif.
Hill-Clarke Mchry. Co., 647 W. Washington Blvd., Chicago.
Industrial Mchry. Corp., Indianapolis.
Industrial Trading Corp., 227 Fulton St., N. Y. C.
Iron & Steel Products, Inc., Chicago.
Iroquois Mchry. Co., 656 Ohio St., Buffalo, N. Y.
Knox, Earl E., Co., Erie, Pa.
Lucas, J. L., & Son, Inc., Bridgeport, Conn.
McKey, Frank M., Trustee, Grigsby-Grunow Co., Inc., 5801 Dickens Ave., Chicago.
Machinery Dealers, Inc., New Haven, Conn.
Marr-Galbreath Mchry. Co., Pittsburgh.
Midland Steel & Equip. Co., Chicago.
Miles Mchry. Co., Saginaw, W. S. Mich.
Mullin, Colman J., 50 Church St., N. Y. C.
Nutmeg State Mchry. Corp., The, New Haven, Conn.
O'Brien Machinery Co., Philadelphia.
Oviatt, D. C., & Co., Cleveland.
RCA Mfg. Co., Inc., Camden, N. J.
Ritterbush & Co., Inc., 30 Church St., N. Y. C.
Riverside Mchry. Depot, Detroit.
Robinson, Harry A., Philadelphia.
Rosenkranz & Weisbecker, 149 Broadway, N. Y. C.
Ross Power Equip. Co., Indianapolis, Ind.
Safe Harbor Water Power Corp., Conestoga, Pa.
Scully-Jones & Co., Chicago.
Simmons Mch. Tool Corp., Albany, N. Y.
Stanhope, R. C., Inc., 101 W. 31st St., N. Y. C.
Sun Mchry. Co., Inc., Newark, N. J.
Sutton Eng. Co., Pittsburgh, Pa.
United Pipe & Supply Co., Inc., Norristown, Pa.
Wilke, A. D., Mchry. Co., Chicago.
Wigglesworth Mchry Co., Cambridge, Mass.

SEPARATORS—Magnetic
Dings Magnetic Separator Co., Milwaukee.
Magnetic Mfg. Co., 626 South 28th St., Milwaukee.

SHAFTING—Cold Drawn
Bliss & Laughlin, Inc., Harvey, Ill.
Union Drawn Steel Co., Massillon, Ohio.
Wyckoff Drawn Steel Co., Pittsburgh, Pa.

SHAFTING—Steel
Union Drawn Steel Co., Massillon, Ohio.

SHAFTING—Turned and Ground
Bliss & Laughlin, Inc., Harvey, Ill.
Moltrup Steel Prods. Co., Beaver Falls, Pa.
Ryerson, Jos. T., & Son, Inc., Chicago.
Union Drawn Steel Co., Massillon, Ohio.
Wyckoff Drawn Steel Co., Pittsburgh, Pa.

SHAPERS
Cincinnati (Ohio) Shaper Co.

SHAPERS—Vertical
Pratt & Whitney Co., Hartford, Conn.

SHAPES—Cold Drawn
Bliss & Laughlin, Inc., Harvey, Ill.
Union Drawn Steel Co., Massillon, Ohio.
Wyckoff Drawn Steel Co., Pittsburgh, Pa.

SHAPES—Wire
Eastern Tool & Mfg. Co., Bloomfield, N. J.
Lee Spring Co., Inc., 30 Main St., Brooklyn, N. Y.
Roebling's, John A., Sons Co., Trenton, N. J.

SHEARING MACHINES—Alligator
Canton (Ohio) Fdry. & Mch. Co.

SHEARING MACHINES—Angle, Hand and Power
Buffalo (N. Y.) Forge Co., 492 Broadway.
Federal Bearings Co., Inc., Poughkeepsie, N. Y.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

SHEARING MACHINES—Bar
Buffalo (N. Y.) Forge Co., 492 Broadway.
Schatz Mfg. Co., The, Poughkeepsie, N.Y.
United Engineering & Fdry. Co., Pgh.

SHEARING MACHINES — Beam and Channel
Buffalo (N. Y.) Forge Co., 492 Broadway.
Schatz Mfg. Co., The, Poughkeepsie, N.Y.
United Engineering & Fdry. Co., Pgh.

SHEARING MACHINES—Billet
Buffalo (N. Y.) Forge Co., 492 Broadway.
Morgan Engineering Co., Alliance, Ohio.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.
United Engineering & Fdry. Co., Pgh.

SHEARING MACHINES, Plate
Bertsch & Co., Cambridge City, Ind.
Buffalo (N. Y.) Forge Co., 492 Broadway.
Cincinnati (Ohio) Shaper Co.
Dreis & Krump Mfg. Co., Chicago.
Mesta Mch. Co., Pittsburgh.
Morgan Engineering Co., Alliance, Ohio.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.
United Engineering & Fdry. Co., Pgh.

SHEARING MACHINES — Sheet and Plate
Beatty Mch. & Mfg. Co., 936—15th St., Hammond, Ind.
Buffalo (N. Y.) Forge Co., 492 Broadway.
Cincinnati (Ohio) Shaper Co.
Dreis & Krump Mfg. Co., Chicago.

SHEARING MACHINES—Squaring
Cincinnati (Ohio) Shaper Co.
Dreis & Krump Co., Chicago.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

SHEET BARS
Andrews Steel Co., The, Newport, Ky.
Jones & Laughlin Steel Corp., Pittsburgh.

SHEET METAL MACHINERY
Cincinnati (Ohio) Shaper Co.
Dreis & Krump Mfg. Co., Chicago.
New Albany (Ind.) Mch. Mfg. Co.
Niagara Mch. & Tool Wks., Buffalo, N. Y.
V & O Press Co., Hudson, N. Y.

SHEET STEEL CONSTRUCTION
Berger Mfg. Co., The, Canton, Ohio.

SHEETS—Aluminum
Aluminum Co. of America, Pittsburgh.

SHEETS—Auto Body
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pgh.
Inland Steel Co., Chicago.
Republic Steel Corp., Youngstown, Ohio.
Weirton (W. Va.) Steel Co.
Youngstown (Ohio) Sheet & Tube Co.

SHEETS—Black
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pgh.
Continental Steel Corp., Kokomo, Ind.
Granite City (Ill.) Steel Co.
Ingersoll Steel & Disc Co., Chicago.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Superior Sheet Steel Co., Canton, Ohio.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Weirton (W. Va.) Steel Co.
Worth Steel Co., Claymont, Del.

SHEETS—Blue Annealed
Alan Wood Steel Co., Conshohocken, Pa.
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pgh.
Central Iron & Steel Co., Harrisburg, Pa.
Granite City (Ill.) Steel Co.
Inland Steel Co., Chicago.
Lukens Steel Co., Coatesville, Pa.
Newport (Ky.) Rolling Mill Co.
Ryerson, Jos. T., & Son, Inc., Chicago.
Superior Sheet Steel Co., Canton, Ohio.
Weirton (W. Va.) Steel Co.
Worth Steel Co., Claymont, Del.

SHEETS—Brass, Bronze, Copper, Nickel Silver or Phosphor Bronze
American Brass Co., Waterbury, Conn.
Phosphor Bronze Smelting Co., Phila.
Revere Copper & Brass, Inc., 230 Park Ave., N. Y. C.
Riverside (N. J.) Metal Co.
Seymour (Conn.) Mfg. Co.

SHEETS—Chrome
American Sheet & Tin Plate Co., Pgh.

SHEETS—Chrome Nickel
American Sheet & Tin Plate Co., Pgh.

SHEETS—Cold Rolled
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Continental Steel Corp., Kokomo, Ind.
Inland Steel Co., Chicago.
Republic Steel Corp., Youngstown, O.
Ryerson, Jos. T., & Son, Inc., Chicago.

SHEETS—Copper Steel
American Sheet & Tin Plate Co., Pgh.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
Superior Sheet Steel Co., Canton, Ohio.

SHEETS—Electrical
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pgh.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
Republic Steel Corp., Youngstown, Ohio.

SHEETS — Enameling
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pgh.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
Superior Sheet Steel Co., Canton, Ohio.

SHEETS—For Drawing and Stamping
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pgh.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Superior Sheet Steel Co., Canton, Ohio.
Weirton (W. Va.) Steel Co.
Worth Steel Co., Claymont, Del.

SHEETS—Full Finished
American Sheet & Tin Plate Co., Pgh.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Weirton (W. Va.) Steel Co.
Youngstown (Ohio) Sheet & Tube Co.

SHEETS—Galvanized, Flat and Corrugated
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pgh.
Bethlehem (Pa.) Steel Company.
Continental Steel Corp., Kokomo, Ind.
Granite City (Ill.) Steel Co.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
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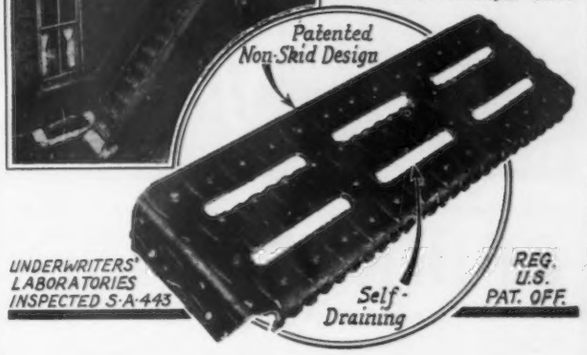

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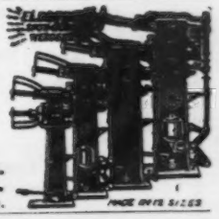

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Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos., T., & Son, Inc., Chicago.
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Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Weirton (W. Va.) Steel Co.
Youngstown (Ohio) Sheet & Tube Co.

SHEETS—Long Terne
American Sheet & Tin Plate Co., Ptgh.
Newport (Ky.) Rolling Mill Co.
Superior Sheet Steel Co., Canton, Ohio.
Weirton (W. Va.) Steel Co.

SHEETS—Magnesium Alloys
Dow Chemical Co., 921 Jefferson Ave., Midland, Mich.

SHEETS—Metal Furniture
American Sheet & Tin Plate Co., Ptgh.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
Republic Steel Corp., Youngstown, Ohio.

SHEETS—Pickled
American Sheet & Tin Plate Co., Ptgh.
Newport (Ky.) Rolling Mill Co.
Superior Sheet Steel Co., Canton, Ohio.
Weirton (W. Va.) Steel Co.

SHEETS—Tin Mill Black
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Ptgh.
Newport (Ky.) Rolling Mill Co.
Weirton (W. Va.) Steel Co.

SHEETS—Zinc
New Jersey Zinc Co., Inc., The, 160 Front St., N. Y. C.

SHELVING—Steel
Berger Mfg. Co., The, Canton, Ohio.

SHOES—Horse and Mule
Burden Iron Co., The, Troy, N. Y.

SLABS
Andrews Steel Co., The, Newport, Ky.
Central Iron & Steel Co., Harrisburg, Pa.

SLINGS—Wire Rope
Roebling's, John A., Sons Co., Trenton, N. J.

SLOTTING MACHINES
Nazel Engng. & Mch. Wks., Philadelphia.

SPACING TABLES—Punching & Shearing
Thomas Spacing Mach. Co., Pittsburgh.

SPECIAL MACHINERY
Baldwin-Southwark Corp., Southwark Div., Philadelphia.
Bullard Co., The, Bridgeport.
Conran, Frederick M., 107 Colden St., Newark, N. J.
Eastern Tool & Mfg. Co., Bloomfield, N. J.
Morgan Engineering Co., Alliance, Ohio.
Wood, R. D., & Co., Philadelphia.

SPECIALTIES—Rubber Covered & Lined
American Hard Rubber Co., 11 Mercer St., N. Y. C.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., The, 2 Townsend St., Passaic, N. J.

SPEED REDUCERS
Boston Gear Wks., Inc., North Quincy, Mass.
Link-Belt Co., Chicago.
Michigan Tool Co., Detroit.
Philadelphia (Pa.) Gear Works.

SPIKES—Track
Ames, W., & Co., Jersey City, N. J.
Illinois Steel Co., Chicago.
Inland Steel Co., Chicago.

SPLICE BARS
Illinois Steel Co., Chicago.
Inland Steel Co., Chicago.

SPONGE IRON
Ekstrand & Tholand, Inc., 441 Lexington Ave., N. Y. C.

SPRAYERS—Metal
Metallizing Co. of America, Inc., Los Angeles, Calif.

SPRING MAKING MACHINERY
Baird Mch. Co., The, Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

SPRINGS—Car
American Steel & Wire Co., Chicago.
Miller & Van Winkle, Inc., 18 Bridge St., Brooklyn, N. Y.

SPRINGS—Extension, Compression, Torsion or Flat
Amer. Spring & Mfg. Corp., Holly, Mich.
American Steel & Wire Co., Chicago.
Barnes-Gibson-Raymond, Inc., Detroit.
Barnes, Wallace, Co., The, Bristol, Conn.
Cook Spring Co., Div. of Barnes-Gibson-Raymond, Inc., Ann Arbor, Mich.
Cuyahoga Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Gibson, Wm. D., Co., Chicago.
Hubbard, M. D., Spring Co., Pontiac, Mich.
Lee Spring Co., Inc., 30 Main St., Brooklyn, N. Y.
Miller & Van Winkle, Inc., 18 Bridge St., Brooklyn, N. Y.
Raymond Mfg. Co., Corry, Pa.
U. S. Steel Spring Co., Cleveland, O.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.

SPROCKETS
Baldwin-Duckworth Chain Corp., Springfield, Mass.
Boston Gear Wks., Inc., North Quincy, Mass.
Whitney Mfg. Co., Hartford, Conn.

STAMPINGS OR DRAWINGS—Metal
Barnes-Gibson-Raymond, Inc., Detroit.
Barnes, Wallace, Co., The, Bristol, Conn.
Berger Mfg. Co., The, Canton, Ohio.
Champion Sheet Metal Co., Inc., cor. Squires & Duane Sts., Cortland, N. Y.
Cook Spring Co. Div. of Barnes-Gibson-Raymond, Inc., Ann Arbor, Mich.
Crosby Co., The, Buffalo, N. Y.
Dunbar Bros., Co., Bristol, Conn.
Eastern Tool & Stpg. Co., Inc., Saugus, Mass
Geuder, Paeschke & Frey Co., Milwaukee.
Gibson, Wm. D., Co., Chicago.
H. & P. Mfg. Co., The, Cleveland.
Hubbard, M. D., Spring Co., Pontiac, Mich.
Lansing (Mich.) Stamping So., So. Penn. Ave.
Lee Spring Co., Inc., 30 Main St., Brooklyn, N. Y.
Miller & Van Winkle, Inc., 18 Bridge St., Brooklyn, N. Y.
Parish Pressed Steel Co., Reading, Pa.
Raymond Mfg. Co., Corry, Pa.
Sheet Metal Specialty Co., Pittsburgh, Pa.
Torrington (Ct.) Co.
Truscon Steel Co., Pressed Steel Div., Cleveland.
Veeder-Root, Inc., Hartford, Ct.
Worcester (Mass.) Stamped Metal Co.

STAMPS—Steel Alphabets and Figures
Noble & Westbrook Mfg. Co., East Hartford, Ct.

STAPLES—Wire
Continental Steel Corp., Kokomo, Ind.
Wickwire Brothers, Cortland, N. Y.

STEEL—Acid Resisting
Duriron Co., Inc., The, 438 N. Findlay St., Dayton, Ohio.

STEEL—Alloy
Alan Wood Steel Co., Conshohocken, Pa.
American Steel & Wire Co., Chicago.
Andrews Steel Co., The, Newport, Ky.
Bethlehem (Pa.) Steel Company.
Bissett Steel Co., The, Cleveland.
Carnegie Steel Co., Pittsburgh.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Harrisburg (Pa.) Steel Corp.
Illinois Steel Co., Chicago.
Ingersoll Steel & Disc Co., Chicago.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Pacific Coast Steel Corp., San Francisco, Calif.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Timken Roller Bearing Co., Canton, Ohio.
Timken Steel & Tube Co., The, Canton, Ohio.
Universal Steel Co., Bridgeville, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL—Alloy, Cold Drawn
Bliss & Laughlin, Inc., Harvey, Ill.
Moltrup Steel Prods. Co., Beaver Falls, Pa.
Union Drawn Steel Co., Massillon, Ohio.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.
Wyckoff Drawn Steel Co., Pittsburgh, Pa.

STEEL—Bright Finished
Union Drawn Steel Co., Massillon, Ohio.

STEEL—Carbon
Andrews Steel Co., The, Newport, Ky.
Carnegie Steel Co., Pittsburgh.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Harrisburg (Pa.) Steel Corp.
Ingersoll Steel & Disc Co., Chicago.
Latrobe (Pa.) Electric Steel Co.

STEEL—Carbon Vanadium
Andrews Steel Co., The, Newport, Ky.
Latrobe (Pa.) Electric Steel Co.

STEEL—Chrome
American Steel & Wire Co., Chicago.
Andrews Steel Co., The, Newport, Ky.
Latrobe (Pa.) Electric Steel Co.

STEEL—Chrome Manganese
Latrobe (Pa.) Electric Steel Co.

STEEL—Chrome Nickel
American Steel & Wire Co., Chicago.
Andrews Steel Co., The, Newport, Ky.
Harrisburg (Pa.) Steel Corp.
Latrobe (Pa.) Electric Steel Co.

STEEL—Chrome Nickel Silver
Ingersoll Steel & Disc Co., Chicago.

STEEL—Chrome Vanadium
Andrews Steel Co., The, Newport, Ky.
Harrisburg (Pa.) Steel Corp.
Latrobe (Pa.) Electric Steel Co.
Universal Steel Co., Bridgeville, Pa.

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STEEL—Cold Drawn
American Steel & Wire Co., Chicago.
Bliss & Laughlin, Inc., Harvey, Ill.
Jones & Laughlin Steel Corp., Pittsburgh.
Latrobe (Pa.) Electric Steel Co.
Moltrup Steel Prods. Co., Beaver Falls, Pa.
Rathbone, A. B. & J., Palmer, Mass.
Ryerson, Joseph T., & Son, Inc., Chicago.
Union Drawn Steel Co., Massillon, Ohio.
Wyckoff Drawn Steel Co., Pittsburgh, Pa.

STEEL—Cold Rolled Strips
Acme Steel Co., Chicago.
American Steel & Wire Co., Chicago.
Athenia Steel Co., 135 William St., N. Y.
Cold Metal Process Co., The, Youngstown, Ohio.
Griffin Mfg. Co., Erie, Pa.
Inland Steel Co., Chicago.
Latrobe (Pa.) Electric Steel Co.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Stanley Works, The, New Britain, Conn.; Bridgeport, Conn.
Steel & Tubes, Inc., Cleveland.
Superior Steel Corp., Grant Bldg., Ptgh.
Thomas Steel Co., Warren, Ohio.
Weirton (W. Va.) Steel Co.
West Leechburg Steel Co., Pittsburgh.
Wetherell Bros. Co., Cambridge, 39, Mass.

STEEL—Cold Rolled Strips, Electric Copper Coated
Thomas Steel Co., Warren, Ohio.

STEEL—Cold Rolled Strips, Electro-Galvanized
Thomas Steel Co., Warren, Ohio.

STEEL—Cold Rolled Strips, Electro Tin Coated
Thomas Steel Co., Warren, Ohio.

STEEL—Cold Rolled Strips, Stainless
Acme Steel Co., Chicago.
Griffin Mfg. Co., Erie, Pa.

STEEL—Corrosion Resisting
American Steel & Wire Co., Chicago.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Midvale Co., The, Nicetown, Phila., Pa.

STEEL—Crucible
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL—Cutlery
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Universal Steel Co., Bridgeville, Pa.

STEEL—Die
Andrews Steel Co., The, Newport, Ky.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Disston, Henry, & Sons, Inc., Philadelphia.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Milne, A., & Co., 745 Washington St., N. Y. C.
Universal Steel Co., Bridgeville, Pa.

STEEL—Drill
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Milne, A., & Co., 745 Washington St., N. Y. C.
Pacific Coast Steel Corp., San Francisco, Calif.
Universal Steel Co., Bridgeville, Pa.

STEEL—Electric
Disston, Henry, & Sons, Inc., Philadelphia.
Inland Steel Co., Chicago.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Timken Steel & Tube Co., The, Canton, O.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL—High Speed
Bethlehem (Pa.) Steel Company.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Ingersoll Steel & Disc Co., Chicago.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Milne, A., & Co., 745 Washington St., N. Y. C.
Universal Steel Co., Bridgeville, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL—Hot Rolled Strips
Acme Steel Co., Chicago.
Illinois Steel Co., Chicago.
Inland Steel Co., Chicago.
Laclede Steel Co., St. Louis, Mo.
Latrobe (Pa.) Electric Steel Co.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Stanley Works, The, New Britain, Conn.; Bridgeport, Conn.
Steel & Tubes, Inc., Cleveland.
Superior Steel Corp., Grant Bldg., Ptgh.
Weirton (W. Va.) Steel Co.
West Leechburg Steel Co., Pittsburgh.

STEEL—Hot Rolled Strips, Electro Zinc Coated
Thomas Steel Co., Warren, O.

STEEL—Hot Rolled Strips, Galvanized
Acme Steel Co., Chicago.

STEEL—Magnet
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Latrobe (Pa.) Electric Steel Co.

STEEL—Nickel
Andrews Steel Co., The, Newport, Ky.

STEEL—Open Hearth
Andrews Steel Co., The, Newport, Ky.
Pittsburgh (Pa.) Steel Co.
Timken Roller Bearing Co., Canton, Ohio.
Timken Steel & Tube Co., The, Canton, O.

STEEL—Rustless
Acme Steel Co., Chicago.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Griffin Mfg. Co., Erie, Pa.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.

STEEL—Screw
Bliss & Laughlin, Inc., Harvey, Ill.
Ryerson, Jos. T., & Son, Inc., Chicago.
Timken Roller Bearing Co., Canton, Ohio.
Timken Steel & Tube Co., The, Canton, O.
Union Drawn Steel Co., Massillon, Ohio.
Wyckoff Drawn Steel Co., Pittsburgh, Pa.

STEEL—Special Analysis
Andrews Steel Co., The, Newport, Ky.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Harrisburg (Pa.) Steel Corp.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Republic Steel Corp., Youngstown, Ohio.
Timken Roller Bearing Co., Canton, Ohio.
Timken Steel & Tube Co., The, Canton, O.
West Leechburg Steel Co., Pittsburgh.

STEEL—Spring
Athenia Steel Co., 135 William St., N. Y.
Barnes-Gibson-Raymond, Inc., Detroit.
Barnes, Wallace, Co., The, Bristol, Conn.
Gibson, Wm. D., Co., Chicago.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Timken Roller Bearing Co., Canton, Ohio.
Timken Steel & Tube Co., The, Canton, O.

STEEL—Stainless
Acme Steel Co., Chicago.
American Steel & Wire Co., Chicago.
Bethlehem (Pa.) Steel Company.
Carnegie Steel Co., Pittsburgh.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Disston, Henry, & Sons, Inc., Philadelphia.
Illinois Steel Co., Chicago.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Midvale Co., The, Nicetown, Phila., Pa.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Union Drawn Steel Co., Massillon, Ohio.
Wetherell Bros. Co., Cambridge, 39, Mass.

STEEL—Stainless Clad
Ingersoll Steel & Disc Co., Chicago.

STEEL—Tool
Bethlehem (Pa.) Steel Company.
Bissett Steel Co., The, Cleveland.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Disston, Henry, & Sons, Inc., Philadelphia.
Ingersoll Steel & Disc Co., Chicago.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Midvale Co., The, Nicetown, Phila., Pa.
Milne, A., & Co., 745 Washington St., N. Y. C.
Ryerson, Jos. T., & Son, Inc., Chicago.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Universal Steel Co., Bridgeville, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL—Tool, Special Shapes
Forging & Casting Corp., The, Ferndale, Mich.
Latrobe (Pa.) Electric Co.

STEEL—Vanadium
Andrews Steel Co., The, Newport, Ky.
Latrobe (Pa.) Electric Steel Co.
Universal Steel Co., Bridgeville, Pa.

STEEL PLANTS AND ROLLING MILLS
Perin Engineering Co., Inc., 535 Fifth Ave., N. Y. C.

STEEL ROLLS
United Engineering & Fdry. Co., Ptgh.

STOCKS AND DIES
Jones & Lamson Mch. Co., Springfield, Vt.

STOKERS
Babcock & Wilcox Co., The, 85 Liberty St., N. Y. C.

STOPS—Crane Limit
Electric Controller & Mfg. Co., Cleveland.

STRAIGHTENING MACHINES—Bar & Tube
Conran, Frederick M., 107 Colden St., Newark, N. J.
Medart Co., The, St. Louis, Mo.

STRAIGHTENING MACHINES—Wire
Lewis Mch. Co., Cleveland.

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Acme Steel Co., Chicago.

STRUCTURAL IRON AND STEEL WORK
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SUB PRESSES
Danly Machine Specialties, Inc., Chicago.

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Babcock & Wilcox Co., The, 85 Liberty St., N. Y. C.

SWAGING MACHINES
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Westinghouse Elec. & Mfg. Co., East Ptgh.

TANK LININGS—Rubber
American Hard Rubber Co., 11 Mercer St., N. Y. C.
Goodrich, B. F., Co., Akron, Ohio.

NIAGARA BRAND
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TANKS—Rubber Lined
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TAPS—Collapsing
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National Mchry. Co., Tiffin, Ohio.

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Republic Steel Corp., Youngstown, Ohio.
Weirton (W. Va.) Steel Co.
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TOOL BITS
Carboloy Co., Inc., 2985 E. Jefferson Ave., Detroit.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.

TOOL HOLDERS
Armstrong Bros. Tool Co., Chicago.

TOOLS—Lathe
Armstrong Bros. Tool Co., Chicago.
Carboloy Co., Inc., 2985 E. Jefferson Ave., Detroit.

TOOLS—Metal Cutting
Carboloy Co., Inc., 2985 E. Jefferson Ave., Detroit.
Pratt & Whitney Co., Hartford, Conn.

TOOLS—Tungsten Carbide
Carboloy Co., Inc., 2985 E. Jefferson Ave., Detroit.

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Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
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Blaw-Knox Co., Pittsburgh.
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Norton Co., Worcester, Mass.

TRUCKS—Elevating (Power)
Elwell-Parker Electric Co, The, Cleveland.
Yale & Towne Mfg. Co., Stamford, Conn.

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Atlas Car & Mfg. Co., Cleveland.
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Yale & Towne Mfg. Co., Stamford, Conn.

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United Engineering & Fdry. Co., Ptgh.

TUBES—Boiler
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TUBES—Boiler, Charcoal Iron
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TUBES—Nickel Silver
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Revere Copper & Brass, Inc., 230 Park Ave., N. Y. C.

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TUBING—Hard Rubber
American Hard Rubber Co., 11 Mercer St., N. Y. C.

TUBING—Magnesium Alloys
Dow Chemical Co., 921 Jefferson Ave., Midland, Mich.

TUBING—Nichrome
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TUBING—Open Seam
Steel & Tubes, Inc., Cleveland.

TUBING—Phosphor Bronze
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TUBING—Rubber
Goodrich, B. F., Co., Akron, Ohio.

TUBING—Seamless Steel
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Ryerson, Jos. T., & Sons, Inc., Chicago.
Steel & Tubes, Inc., Cleveland.
Timken Roller Bearing Co., The, Canton, Ohio.
Timken Steel & Tube Co., The, Canton, Ohio.
Youngstown (Ohio) Sheet & Tube Co.

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Steel & Tubes, Inc., Cleveland.

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Steel & Tubes, Inc., Cleveland.
Youngstown (Ohio) Sheet & Tube Co.

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Steel & Tubes, Inc., Cleveland.
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Carboloy Co., Inc., 2985 E. Jefferson Ave., Detroit.

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Morse Twist Drill & Mch. Co., New Bedford, Mass.

TYPE—Steel
Noble & Westbrook Mfg. Co., East Hartford, Ct.

UNIONS
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Garlock Packing Co., The, Palmyra, N. Y.
Jenkins Bros., 80 White St., N. Y. C.

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Westinghouse Air Brake Co., Industrial Div., Pittsburgh.

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Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.
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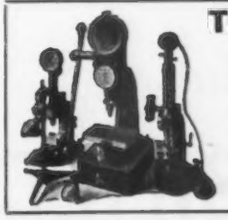
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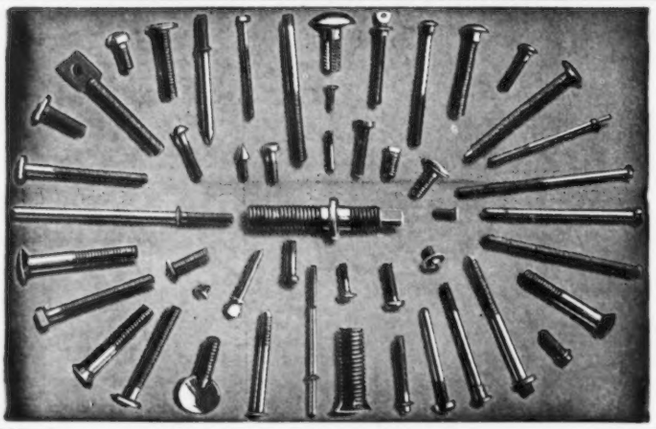

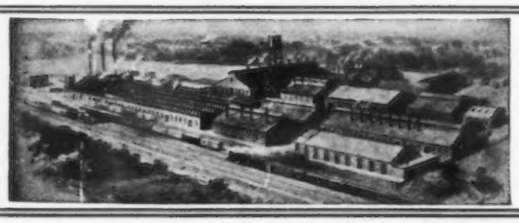

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Established 1915

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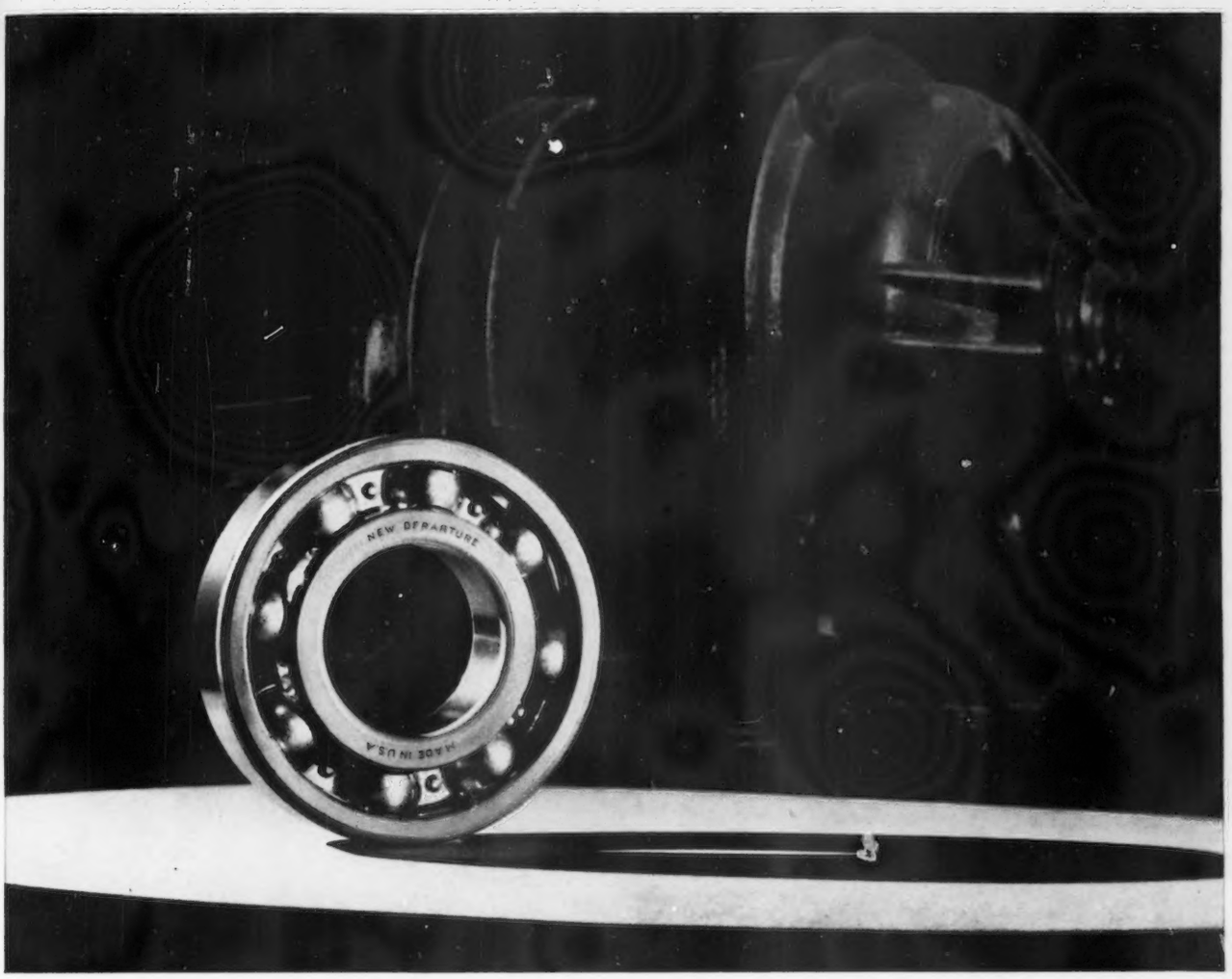

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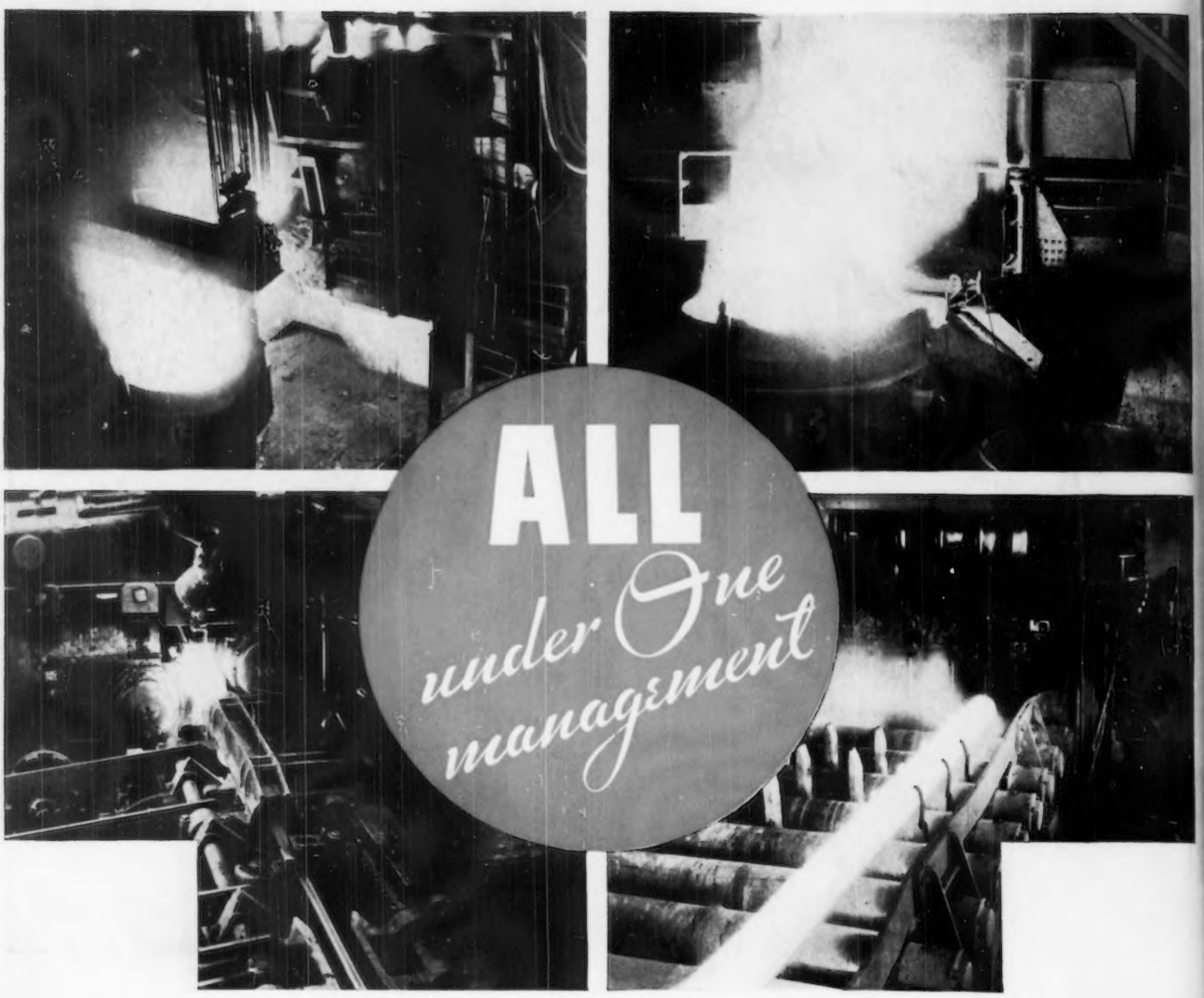

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